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METALS and ALLOYS

The Magazine of Metallurgical Engineering

PRODUCTION • FABRICATION • TREATMENT • APPLICATION

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Highlights

WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF

Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.

Scrapping Russian Marine Engine Cylinders

American producers of marine engines should be interested in the novel explanation by Skorodzievski (page MA 662 R 2) for scrapping 40 per cent of the Russian production of marine engine cylinders.—B.W.G.

Revolve Rotors Until They Explode

Interesting tests are described by Pollock and Collie (page MA 685 L 6) whereby small rotors are made to revolve at increasing speeds until they explode. The plastic state existing in the interior of the rotating body, when the stresses exceed the yield point of the material, spreads outward until the whole reaches a plastic state and rupture takes place.—B.W.G.

Transformation Kinetics in Russia

Within the last few years the subject of kinetics of transformation seems to have become fashionable in the metallurgical world. This month's abstracts afford a glimpse at the status of the matter in Russia. Kornfeld and Schamarin (page MA 686 L 2) continue their study of nucleus formation during recrystallization of Al. Hagen-Torn (page MA 686 L 4) has things to say about the crystallization rate of ingots, as does Andronikaschwili (whew!) (page MA 686 L 5). The austenite-pearlite transformation receives its share of attention from Mirkin and Blanter (page MA 686 L 8) and Kazeev and Reznik (page MA 686 R 2). This transformation, of course, is of great interest to ferrous metallurgists, and there exist data for comparison.

It seems likely that many workers in the field have now become more or less expert at statistics. If they find that the brand of the Russian school holds no challenge, they might try their hands at examining the methods used at Duke University to "prove" ESP (extra-sensory perception, if you haven't heard of it yet) which also has a good chance of becoming fashionable.—J.S.M.

"And Lesser Fleas to Bite 'em"

Take a copper ore from the Southwest containing a percent or so of copper and concentrate it by flotation and you're likely to find interesting quantities of molybdenum in the concentrate, though you'd never mine the ore for Mo alone. Now Bibikowa (page MA 658 L 2) says some molybdenite ore contains 0.00012% Rhenium, recoverable in bag houses on roasting the ore.—H.W.G.

Flotation

Flotation is certainly cosmopolitan. Russia (page MA 658 L 2, L 9, R 4 and R 8), Holland, (page MA 658 L 8), Australia (page MA 658 R 2), Japan (page MA 658 R 6) and Norway (page MA 659 R 2) provide flotation abstracts on one galley of the proof for this issue. While all seem still to be groping for the why of flotation, all also seem to be able to make it work.—H.W.G.

"In Xanadu did Kubla Khan"

One reason why flotation always interests us is because no article gets far without referring to Xanthates, and it's a nice-sounding word. Others occur as names of mining localities—we note Pacajake (page MA 704 R 2), Outokumpu (page MA 659 R 2) and Mococo (page MA 659 R 8). If you don't like these perhaps you'll find a musical note in the names of the Russian and Japanese authors.—H.W.G.

Gas Welding Performance

Much experimenting has been done to determine gas consumptions, speeds and other performance data for various types of oxyacetylene welds (MA 676 L 4). Results obtained are lacking in uniformity due to many variable factors involved. To begin with, most oxyacetylene welding is done by hand and, therefore, is subject to the wide variations common to all handicrafts. But the principal possibility for differences in results lies in the operator himself. No two men weld exactly alike and even the same man may turn in quite variable performances on two consecutive days. Experienced operators and men on repetitive production work gain more control over the molten weld metal. This enables them to use larger tips in their torches, giving off more heat and speeding up the work proportionately. Marked economies in gas consumptions are also obtained in this manner, for the faster a weld is made the less gas it takes. Finally, new gas welding procedures have practically doubled the speed while cutting the consumption of both gases and welding rod in half during recent years. Further developments along this line may be expected. Therefore, gas welding performance data should not be taken as more than a guide, which improved procedures may render obsolete at any time.—E.V.D.

Ain't Figures Wonderful?

Maier (page MA 659 R 8) "estimates" the cost of production of sponge iron cinder at $14.864 per ton in a 10 ton per day plant. In the interests of meticulousness why not state whether it's a net or gross ton and give details of the calibration of the slip-stick? Personally that last $0.004 makes us decline to buy any stock in the process.—H.W.G.

Cyanide

The title "fatal accident on a cyanide hardening furnace" (page MA 704 R 10) made us wonder if some heat-treater had been poisoned, but it turns out that it was a burn by splashing. Guess everybody has such a wholesome respect for cyanide that it never goes in the mouth. You recall Liddell's discussion, his list of antidotes ends with "then call the undertaker."—H.W.G.

Die Castings

Street (page MA 660 R 5) asks "what shall a die-casting contain"? We prefer ours without blow holes or alligator-skin marks from a heat-checked die, if it's all the same to you.—H.W.G.

Gases in Metals

Chaudron (page MA 660 R 3) says if you irritate a metal by cathodic bombardment it gives up its gas. We'd want to be sure that said bombardment didn't cause reactions among the gases and fool us as to what was in the metal in the first place. He speaks of aluminum carbonyl—is there proof that there is any such animal?—H.W.G.

Best Criterion of Corrosion Damage

Crampton and Mitchell (page MA 698 L 2) consider tensile strength measurements to be the best criterion of damage by corrosion. Even with close control over influencing factors and close checks on results, proper interpretation for service behavior must take into consideration the causes and forms of corrosion.—B.W.G.

Russians Study O_2—Enriched Air for Blast Furnace

The use of oxygen enriched air for the iron blast furnace, long a topic of conversation and occasionally of tests in this country, is being investigated in Russia. Messerle (page MA 659 L 10) claims many advantages from using a blast containing 30-60 per cent O_2, including the hopeful ones of the production of steel direct in the blast furnace, of a high quality slag for Portland cement, and (with 60 per cent O_2) a blast furnace gas that can be used for the synthesis of ammonia.—B.W.G.

Novel Way to Test Steel Tools

One way to test wear resistance of steel tools is to machine bricks with them. Knipp (page MA 698 L 5) finds enough weight loss from the tool when machining burnt magnesite brick under standard conditions to draw some conclusions on the comparative wearing properties of various steels to mineral materials. Addition of Cr to steel gave the greatest increase in wear resistance.—B.W.G.

Temper Brittleness

There still remains much that is not understood regarding the mechanism of temper brittleness in various alloys. The abstract of a research by Yokoyama (page MA 667 R 3) supplies some new data and presents an interesting generalization and a classification of the types of temper brittleness.—O.E.H.

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EDITORIAL

Fundamental Research in Metallurgy

A 388 page report has been published recently by the National Resources Committee entitled, "Technological Trends and National Policy."

This report is full of interesting information and speculation on the present status and future developments expected in various fields of technology, with considerable emphasis placed on the social aspects of technological progress. For a concise review of what is happening or likely to happen in almost any field of industry, including agriculture, for example, this is undoubtedly the most convenient and authoritative reference to be found. The chapter on Metallurgy by C. C. Furnas of Yale University is, of course, particularly interesting.

The supremacy of the United States in quickly exploiting a metallurgical development by expanding a laboratory process to a huge commercial production is well recognized. While we have excelled in the past in large scale production and in the business courage, commercial organization and technical efficiency to put across new ideas, the records as to where these new ideas originated are not the source of equal pride. Dr. Furnas finds that the rest of the world has been ahead in fundamental metallurgical research and is beginning to catch up in efficiency of production. In reviewing past metallurgical developments a disconcerting number of them started in Germany or England, or elsewhere, with a few notable exceptions.

Conceding that the United States may have lagged in fundamental metallurgical research in the past, being busy with production problems, how do we stand now? As an indication, an interesting survey by Dr. R. F. Mehl of Carnegie Institute of Technology is cited. He investigated all the research articles published in the last two years having a bearing on metallurgy. This compilation when divided among the nations represented gave the following ratios:

Germany	7
United States	4
Great Britain	2
Russia	2
France	1
Japan	1

Naturally, the relative number of articles on research do not necessarily show the relative importance of the work done. The average research article from Russia, for instance, will scarcely equal that from Great Britain, but there is little reason to believe that the quality of the average research article is above that of a German technical report, so there is small chance of improving our position in the list on a quality basis. A glance through the abstract section of METALS AND ALLOYS readily confirms the fact that for new fundamental information, not reviews or descriptive articles, a remarkably large percentage of the abstracts come from other countries, of which the German articles are particularly conspicuous.

This situation is not particularly unknown. Practically everyone engaged in fundamental metallurgical research, and frequently in practical research as well, will tell the same story—that to get information on his subject he first reads the American and English literature because it is readily accessible and easy to read, but to actually keep abreast of the essential literature he must sooner or later go to the German magazines.

The large number of articles on metallurgical subjects appearing in the technical literature of other countries is not due to the individual brilliance of a few investigators; rather, it is an indication of widespread research activity. As Dr. Furnas points out, in Germany alone there are 15 institutes engaged exclusively in metal research. These are well established and most of them have been in operation for some time. Visitors to Europe in general and to Germany in particular invariably bring back the same observation, that research investigations along all lines, but especially in metals, the most important of industrial raw materials, are being encouraged in every way. This is not just for war materials, as many seem to think, but to uncover fundamental information to broaden the field of usefulness and adaptability of the metals.

It is probably fortunate for our industrial position that the information obtained in technical research all over the world is available for our use. Our vast commercial organization, metal resources and the world's best market forms good soil for new ideas growing from the fundamental research of others. As the importance of metallurgical research becomes more widely recognized in this country we should pull up even with the leaders; until that time comes, all honor to the pace being set by Germany in fundamental metallurgical research.—B. W. G.

Few will entirely disagree with the point of view expressed by Furnas and Mehl and brought out above by Dr. Gonser. Yet if a German writer wanted to impress his readers with the necessity of support for German research, he could just as readily and just as correctly point out that lots of important fundamental work is coming from England and America and that Germany must get a move on to keep from being left behind. If we define fundamental research as finding important new facts and describing them so clearly that the matter is settled once for all, certainly the continued work of the N. P. L. is at least the equivalent of a whole lot of the best German work.

Nor need the United States have too much of an inferiority complex. Is not the work of the Aluminum Co. of America on high purity aluminum alloys top notch? Where has the clear thinking and lucid exposition of metallurgical fundamentals of H. M. Howe been equalled? Nowhere, but we name Ed. Bain as the modern runner-up. We'd rather have four of his articles than seven of most German articles. Merica's pioneer work on age hardening; Northrup's development of that most important tool, the high frequency furnace; Herty's work with the open-hearth; Moore's clarification of the fatigue problem; and the A.S.T.M. atmospheric exposure tests—all, in their varying fields, are so indispensable that any other country might well envy us for having such men and organizations.

To come right down to date, the appreciation of the effect of grain size in steel is a matter of highest importance, which other countries are only tardily grasping.

We think that an admonition to maintain the United States standard of research so far set is quite as much in order as to try to draw comparisons between the quality and quantity of work done here and in other countries.—H. W. G.

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CURRENT

Metallurgical Abstracts

A DIGEST OF THE IMPORTANT METALLURGICAL DEVELOPMENTS OF THE WORLD

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CLASSIFICATIONS

1. ORE CONCENTRATION

Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c), Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).

2. ORE REDUCTION

Non-Ferrous (2a), Ferrous (2b).

3. MELTING, REFINING AND CASTING

Non-Ferrous (3a,) Ferrous (3b).

4. WORKING

Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching Drawing & Stamping (4c), Machining (4d).

5. HEAT TREATMENT

Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).

6. FURNACES, REFRACTORIES AND FUELS

7. JOINING

Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).

8. FINISHING

Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (8f).

9. TESTING

Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).

10. METALLOGRAPHY

11. PROPERTIES OF METALS AND ALLOYS

Non-Ferrous (11a), Ferrous (11b).

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

13. CORROSION AND WEAR

14. APPLICATION OF METALS AND ALLOYS

Non-Ferrous (14a), Ferrous (14b).

15. GENERAL

Economic (15a), Historical (15b).

1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

Rhenium as a By-product of the Production of Ammonium Molybdate. V. I. BIBIKOVA (Inst. Rare Metals, Moscow) *Redkie Metal,* Vol. 5, Sept.-Oct. 1936, pp. 25-28. In Russian. Plant research. During roasting of molybdenite ore containing 0.00012% Re at 550-650° about 90% of the Re is volatilized and escapes through the stack. Recovery can be effected by use of wool bags. HWR (1)

Beneficiating Low-grade Iron Ores. E. W. DAVIS (Univ. Minnesota) *Steel,* Vol. 100, May 10, 1937, pp. 48-50, 88-89; May 24, 1937, pp. 38-41. Describes magnetic ore roasting furnace at Cooley, Minn., and gives details of operating conditions. Ore that can not be concentrated by washing or jigging is roasted to Fe_3O_4 and concentrated on magnetic separators. Results indicate that high-grade ore may be produced. Shaft-furnace, divided into feeding, heating, reducing, and cooling zones, is used. Baffles are specially arranged to form uniform mixture of coarse and fine ore and to obtain uniform motion of ore through heating zone. Reducing gas is formed by vaporizing fuel-oil. MS (1)

Mining on the Pacific Coast. JOHN S. STEVENSON. *Can. Chem. Met.,* Vol. 21, May 1937, pp. 157-159. An historical analysis of developments and a discussion of deposits and methods of recovery. WHB (1)

Patino—Leading Producer of Tin. (I) The Ore Deposits of Llallagua. D. C. DERINGER & JOHN PAYNE, JR. (Patino & Enterprises Consolidated) *Eng. Mining J.,* Vol. 138, Apr. 1937, pp. 171-177; **(II) Mining Practice at Llallagua—Crushing and Sorting the Ore.** *Ibid.,* May 1937, pp. 232-238. An illustrated description with tabulated data on production, costs, etc. WHB (1)

1a. Crushing, Grinding & Plant Handling

Reduction of Free-milling Gold Ores and the Pinder Stamp. ARTHUR B. FOOTE. *Mining and Met.,* Vol. 18, Apr. 1937, pp. 197-198. Recovery of Au from ball mill product is more difficult than from a stamp product. Recommends the use of stamps and plates before flotation or cyanidation. VSP (1a)

Crushing Plant at Climax. W. L. FEWSMITH (Robins Conveying Belt Co.) *Mining Congr. J.,* Vol. 23, July 1937, pp. 69, 74. Crushing plant at Climax Molybdenum Co.'s Colorado mill has a capacity of 1000 tons of ore per hour, crushing down to ¼ in. size. A pair of 48 x 60 in. jaw crushers reduce the ore to 6 in. size. These are followed by two standard 7 ft. gyratory crushers discharging the ore at 1½ in., and finally by five 7 ft. short head gyratories. BHS (1a)

1c. Flotation

Separation of Substances by Flotation. F. K. TH. VAN ITERSON. *Proc. Koninkl. Akad. Wetenschappen, Amsterdam,* Vol. 40, No. 2, 1937, pp. 94-100, No. 3, pp. 228-226. Fairly up-to-date review under the following headlines: geometry of flotation, some physical facts about surface tension, the action of flotation agents collectors, frothing agents, activators, depressing agents, sulphidizers, promoters, conserving agents, pH-regulators, dispersing agents) the coal-slurry flotation plant of the State Mines in Limburg, and economical aspects of flotation. EF (1c)

Electro-capillary Phenomena and the Wetting of Metals III. Influence of Surface-active Substances on Wetting Property of Multi-molecular Layers. B. KABANOW & N. IVANISHENKO (Karpov Inst. Phys. Chem. Moscow) *Acta Physicochim. URSS.* Vol. 6, No. 5, 1937, pp. 701-718. In English. Original research carried out with the object of aiding the understanding of the "elementary act in the flotation process, i.e. sticking of a gas bubble to the surface of an ore particle." The effect of different surface-active substances on the contact angle of a bubble at the Hg-electrolyte surface was investigated. Inter-facial tension values are calculated. Effect of changes in polarization of the Hg on the contact angle was studied. See also *Metals and Alloys,* Vol. 6, Jan. 1937, p. MA1. EF (1c)

2 **The Physical Chemistry of Flotation IX. The Adsorption of Xanthates by Activated Carbon and Graphite and Its Relation to the Theory of Flotation.** IAN WILLIAM WARK & ALWYN BIRCHMORE COX (Univ. Melbourne) *J. Phys. Chem.,* Vol. 41, May 1937, pp. 673-677. Continuation of previous research. (See also *Metals and Alloys,* Vol. 8, April 1937, p. MA 200R/7.) The adsorption of the xanthates by sugar charcoal was studied and an attempt made to interpret it in terms of exchange adsorption reactions. Some K ion is adsorbed simultaneously with the xanthate ion. Alkali is liberated corresponding to the difference between the xanthate and potassium ions adsorbed. Addition of alkali decreases the amount of xanthate adsorbed in a given time. Cyanide is without marked effect. With graphite, the xanthate ions abstracted and the alkali liberated are approximately equivalent, little or no K being abstracted. A sample of sugar charcoal prepared by carburizing sugar with sulfuric acid was more active than a sample prepared by thermal carburization. The xanthates are flotation collectors for sugar charcoal. It is concluded that the flotation of graphite by xanthates is not due to any metallic impurities contained therein. EF (1c)

4 **Concentration of Chikoi Molybdenum Ore.** B. I. ROZOV & D. I. NEDOGOVOROV (Inst. Rare Metals, Moscow) *Redkie Metal.,* Vol. 5, Nov.-Dec. 1936, pp. 18-27. In Russian. Original research. This ore contains 0.6% Mo in the form of MoS_2 and 0.065% P as apatite. Flotation yields satisfactory results using 80-100 g. pine oil, 200 g. kerosene, and 250-350 g. Na_2SiO_3/ton. The Na_2SiO_3 successfully depresses the P. The concentrate contains about 25% Mo and 0.20% P with a recovery of 80%. HWR (1c)

5 **The Flotation of Stibnite.** GAICHI YAMADA & YUKIE YOKOYAMA. *Suiyokwai-Shi,* Vol. 9, June 1937, pp. 245-250. Original research. Ichinokawa stibnite, crushed to −65, +250 mesh was studied. Experiments were made on the flotation of stibnite in solutions of various pH to which different flotation reagents and 100 g./ton of each of several chemicals were added. Using camphor white oil but no other chemicals in a solution of pH 2 to 12 before flotation, two buffered pH were found to exist at 4.0 and 7.1 that coincided with the critical pH of floatability of stibnite. In the presence of camphor white oil and K ethyl xanthate, only one buffered pH was found, at 6.5, and the floatability of stibnite was markedly increased in the pH range of 4 to 6.5. $CuSO_4$ depressed the floatability of stibnite in the pH range of 4 to 7.4 to about 35%. KCN depressed stibnite in the pH range of 3.5 to 7.0 although its floatability in that range was not clearly determined. Tannin depressed stibnite only in the pH range of 6.2 to 7.2; its depression was not so marked as that of other sulphide minerals. Lead acetate activated stibnite in the narrow range of pH 6.5 to 6.8; its effect was marked in the presence of only a small amount of frothing oil. In 3.5% NaCl solution stibnite did not float at all at higher pH values than 6.9, i.e., in neutral or alkali solution. HN (1c)

8 **Flotation of Selenium from Sulphuric Acid Plant Slimes.** F. N. BELASH (Inst. Rare Metals, Moscow) *Redkie Metal.,* Vol. 5, Sept.-Oct. 1936, pp. 15-19. In Russian. Original research. Flotation of pyrite residues containing 3.76% Se, 34.95% Pb, 26.13% SiO_2, and 1.90% Fe with aldol recovered 75% of the Se in a concentrate containing 35% Se. No attempt was made to depress Pb. HWR (1c)

1e. Amalgamation, Cyanidation & Leaching

9 **Some of the Factors which Influence the Rate of Dissolution of Gold and Silver in Cyanide Solutions.** E. BEYERS. *J. Chem. Met. Mining Soc., S. Africa,* Vol. 37, Apr. 1937, pp. 524-526. Discussion. See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 201L/5. AHE (1e)

10 **Cyanidation of Arsenical Ores.** *Chem. Eng. Mining Rev.,* Vol. 29, Mar. 8, 1937, pp. 233-237. A summary of tests is shown on As-bearing Au ores from Happy Warrior, Aberdare, and Spargo's Reward mines. Brief reports by different authors are given for each of these mines. High Au losses in flotation and cyanidation indicate a very intimate association between the Au and the arsenopyrite. WHB (1e)

2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

Electrolytic Extraction and Refining. H. J. T. ELLINGHAM. *Metal Ind., London,* Vol. 50, Jan. 15, 1937, pp. 57-63. General discussion. Two distinct applications of electrolysis are: electrolytic reduction or extraction, and electrolytic refining. Gives interesting table of metals recovered from molten electrolytes, principle mineral source, composition of electrolyte, temperature, energy consumption, output and principal countries producing. Similar treatment is given for aqueous electrolytes. RWB (2)

Formation of Primary Slags in Blast Furnace. M. OSTROUKHOV. *Metallurg,* Vol. 12, Mar. 1937, pp. 38-46. In Russian. Composition, melting points and viscosity of the most fusible primary blast furnace slags, taken from published data are given. See also *Metals and Alloys,* Vol. 8, June 1937, p. MA 340R/6. (2)

2b. Ferrous

Experiments in the Flash-roasting of Copper Concentrates. F. S. WARTMAN AND OTHERS. *U. S. Bur. Mines, Rept. Investigations* No. 3340, May 1937, pp. 13-22. Original research. Samples of Cu concentrate from several different plants were flash-roasted satisfactorily. SO_2 content of waste gases was considerably higher than would be obtained from a MacDougall-type roaster operated to give a similar calcine. The calcine was in a form suitable for smelting but could not be leached without a separate reducing step which, while quite successful on a small scale, might require too close control for plant use. Experiments on a small electric furnace 2 x 60 in. showed: (1) In the temperature range 100-1100° C., variations in particle size below 100 mesh produced no significant effect on S content of calcine, provided updraft and excess air were used; (2) from 1000 to 1250°, temperature variations produced no marked effect, although S in calcine declined slightly at higher temperatures; below 1000°, S in calcine increased greatly and there was little action below 700°; (3) updraft gave more complete S elimination than downdraft; (4) at 1100°, reaction was complete in less than 2 secs.; (5) utilization of O was remarkably complete, waste gas containing 14% SO_2 and 1% O. Results with a larger oil-fired furnace were concordant except that SO_2 in waste gas could not be raised above 11%. Increasing furnace temperature increases oxidation rate uniformly until fusion occurs, at which point there is an abrupt increase. Further temperature increase is effective only in keeping particles fused longer so that there is more time for oxidation of the last traces of S. Due to high temperatures used, much of the Cu in the calcine is as ferrite, soluble only in strong, hot acid which dissolves both Cu and Fe. If a metal oxide is treated with a gaseous mixture of a reducing gas and its oxidation product (e.g., CO and CO_2 of H_2 and H_2O), the proportion of reducing gas in the mixture must exceed a critical value, determined by the temperature of treatment and the oxide treated, before the oxide will be reduced. The proportion of reducing gas required for Cu oxide is much lower than for Fe oxide, so treatment of Cu ferrite for 2 hrs. at 700° with a mixture of CO and CO_2 (15% CO) made all the Cu and less than ¼ of the Fe soluble in $Fe_2(SO_4)_3$-H_2SO_4 solution. AHE (2a)

Selective Converting. H. R. POTTS (Rio Tinto Co.) *Metal Ind., London,* Vol. 50, June 18, 1937, pp. 673-675. Practical. A method in which 1 part of the Cu bullion is enriched in precious metals and the other impoverished is described. The difficulties met in the introduction of the process are outlined. RWB (2a)

Fusibility of Zinc Bearing Slags of the System FeO-CaO-ZnO-SiO_2 M. V. ZAITSEV & E. J. FEIGINA. *Tsvetnye Metal.,* No. 4, May 1936, pp. 60-75. FeO-SiO_2-CaO slags, of compositions occurring in smelting Cu and Pb sulphide concentrates, were prepared by melting materials in Fe and/or Al_2O_3 crucibles with free access of air. Melts were also prepared containing 0.5-14.7% ZnO. Isothermal liquidus curves, determined by means of cooling curves, were plotted on the FeO-CaO-SiO_2 base for the following ranges of ZnO concentrations: 0-4%, 4-8%, and 8-14% ZnO. The isotherms indicate that addition of 4-8% ZnO lowers the liquidus temperatures of the system, while further addition, 8-14% ZnO, raises the liquidus temperatures. The diagrams also indicate a shift in the liquidus isotherms resulting from the addition of ZnO. 19 references. BND (2a)

Utilization of the Outokumpu Deposit (Tillgodogörandet av Outokumpu malmfyndigheten) EERO MÄKINEN. *Tek. Tid.,* Vol. 67, July 10, 1937 (Section *Bergsvetenskap*) pp. 53-55. Outokumpu ore averages 4% Cu, 25% S, 26% Fe, with small amounts of Au, Ag, and Co. Two concentrates are made in the flotation plant, about 50,000-60,000 metric tons annually with 20-22% Cu, 36-37% S and 35% Fe, and 100,000 tons pyrite concentrate with 42-46% S and 50-52% Fe. The latter is used by domestic paper mills for production of SO_2, the cinders from the roasting plant are treated by chlorinating roasting for recovery of Cu and Co, and the final product, very low in S and P, is melted at Imatra, in an electric furnace, producing a high quality pig Fe. The Cu concentrate is melted in an electric furnace and the matte is blown to blister in a Bessemer converter; the blister is refined abroad. SO_2 in the converter gases is recovered by the Imperial Chemical Industries process, absorbtion in basic Al sulphate. About 50 tons of liquid SO_2 is recovered daily. BHS (2a)

Britannia Lead Refinery, Northfleet, Kent. J. O. BETTERTON & H. P. WAGNER. *Bull. Inst. Mining Met.,* No. 391, Apr. 1937, 18 pp.; No. 392, May 1937, pp. 3-14. Description of plant and process. A modified Parkes process is used. Average composition of bullion is Ag 85 troy oz./long ton, As 0.05%, Sb 0.30% and Cu 0.09%. As and Sb are removed in the softening furnace and antimonial Pb is produced from the softer slags. Ag and Cu are removed from the softened bullion by the usual zincing operation. The Pb bath after desilverizing contains 0.53% Zn which is removed by the Cl dezincing process, $ZnCl_2$ being formed and sold. Final Pb product assays 99.998% Pb. AHE (2a)

The Equilibrium Co + $CO_2 \rightleftarrows$ CoO + CO, III (Das Gleichgewicht Co + $CO_2 \rightleftarrows$ CoO + CO, III) A. F. KAPUSTINSKY & E. HOFFMANN (Inst. Appl. Mineralogy, Moscow) *Acta Physicochim, URSS.,* Vol. 6, No. 4, 1937, pp. 487-490. In German. Preliminary note on original research. Same equipment was used as in previous tests (see *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 133L/6). At temperatures of 1393, 1293, 1193, 1093, and 993° C., the reaction constants are 0.159, 0.108, 0.0749, 0.0536, and 0.0326, respectively. The heat of formation of Co oxide is 53,408 cal. and the free energy change is $\Delta F_{298} = 11{,}400$ cal. EF (2a)

2a. Non-Ferrous

Sponge Iron Experiments at Mococo. CHAS. G. MAIER. *U. S. Bur. Mines Bull.* No. 396, 1936, 81 pp. Hydrocarbon gases were catalytically converted to an active reducing gas, then conducted through a specially designed rotary kiln. The 1-ton plant and its operation are described and discussed in detail. Pyrite cinder was the ore used. Addition of 5% or less of CaO to ore prevents sticking in the kiln. Maximum Fe reduction was 96.3%. Zn and S removal are satisfactory when Fe reduction of 90% or more was obtained. Magnetic concentration of cinder reduced insoluble from 14-15% to 3-4%. Average calcines gave a concentrate analyzing Fe 90-92, insoluble 3.5-4, S 0.05, P 0.01, C 0.1-0.2, Cu 0.3-0.5, CaO 3-4, and Zn 0.1-0.3%. Concentrated sponge Fe was made into steel in the open hearth and the product studied. Except for excessive labor in charging bulky material, the heat presented no unusual difficulties. Residual SiO_2 causes a corrosive acid slag. There was a general tendency toward a somewhat greater tensile strength accompanied by a little higher ductility in hot-rolled annealed sheets and cold-drawn wire than in the average plant stock. Total production costs for cinder (exclusive of ore) were estimated at $14.864/ton of Fe for a 10-ton/day plant. AHE (2b)

Use of Oxygen-enriched Blast in the Blast Furnace. K. MESSERLE (Kirov Works) *Stal,* Vol. 6, July 1936, pp. 1-10. In Russian. Plant research and theoretical discussion. The use of blast containing 30-60% O_2 increases the capacity, reduces the fuel consumption, makes operation of furnace more flexible, and produces a high quality slag for Portland cement. If blast contains 60% O_2, the exhaust gases can be used for the synthesis of NH_3. The author claims it is possible to produce O_2 of 97% purity for 2 kopecks/m^3 (0.013 cent/ft^3). Use of O_2 enriched blast should permit production of steel direct in the blast furnace, the open hearth being used only for final refining as in the duplex process. HWR (2b)

3. MELTING, REFINING AND CASTING

G. L. CRAIG, SECTION EDITOR

Physical Factors in Casting of Metals. C. H. DESCH (Nat. Phys. Lab.) *Metal Ind., London,* Vol. 50, June 18, 1937, pp. 680-686. General review. The first condition for obtaining a satisfactory casting is that the metal shall flow evenly into the mold, and shall fill it completely before such freezing occurs as to offer an obstruction to its further flow. This property is termed "flowing power." Viscosity plays only a minor part in casting behavior. Molten metals do not wet their molds, but in narrow channels, there is a resistance to flow due to surface tension. This diminishes as the passage size is increased. The effect is small where the metal has a clean surface. Surface films are formed on some metals, causing casting difficulties. The flowing power is dependent on the freezing range and varies inversely as the solidification interval; thus it is greatest for pure metals and eutectics. Crystal thrust should not be ignored, being a force exerted by the growing crystals. This expansion increases as the freezing range becomes greater. The effect causes considerable porosity. 31 references. RWB (3)

Heat Conductivity of Mold Materials. F. HUDSON. *Metal Ind., London,* Vol. 50, May 21, 1937, pp. 573-575. Original research. Development of plastic mold materials based on their heat conductivity. Standard castings were made for comparison in an open top mold, the bottom of which was composed of the material to be tested, of standard thickness. A thermocouple was placed under the bottom to measure the rate of heat transfer. The maximum temperature was also recorded. Normal molding material had very poor heat conductivity, whereas graphite and carborundum compositions had good heat transfer properties without any other disadvantages. RWB (3)

The Rôle of Nickel Oxide in the Metallurgy of Nickel (Ueber Nickeloxyd in der Metallurgie des Nickels) W. LANGE & E. J. KOHLMEYER (Techn. Hochschule, Berlin) *Metallwirtschaft,* Vol. 16, June 18, 1937, pp. 598-602. Research. The oxidation of Cu-Ni melts by an air blast led to the formation of Ni oxide. In Ni-rich melts this oxide dissolved to a considerable extent. After complete saturation with O a dross containing in the main Cu_2O and NiO separated out. The oxidation products of a series of Ni Cu melts were examined metallographically, chemically, and by means of X-ray structure determinations. GA (3)

Mechanical Aids to Jobbing Foundry Production. J. H. EASTHAM. *Mech. World Eng. Record,* Vol. 101, June 4, 1937, pp. 557-558. Practical. A few instances of beneficial changes are discussed. EF (3)

Review of the Foundry Industry in 1936. *Foundry Trade J.,* Vol. 56, Jan. 21, 1937, pp. 37-82. This number is devoted to a review of the foundry industry in 1936. The following papers are of particular interest: **The Gray-Iron Foundry Industry,** by FRED W. FIRTH; **Development of High-Duty Cast Iron,** by A. B. EVEREST; **The Nickel Industry,** by ROBERTS C. STANLEY; **The Czecho-Slovakian Foundry Industry,** by FR. PISEK; **The Foundry Industry in Scandinavia,** by SIXTEN NILSSON; **Recent Progress in the Belgian Foundry Industry,** by GUSTAVE MASSON; **The French Foundry Industry,** by MAURICE WERTS; **The Italian Foundry Industry,** by GUIDO VANZETTI; **The German Foundry Industry,** by TH. GEILENKIRCHEN; **The Polish Foundry Industry,** by G. GIERDZIEJEWSKI; **The American Foundry Industry in 1936 and Its Prospects for 1937,** by OLIVER SMALLEY; **The South African Foundry Industry,** by A. H. GUY; **Recent Developments in Foundry Research,** by J. G. PEARCE. AIK (3)

Viscosity, Surface Tension and Castability in Metallurgy and, Particularly, in the Foundry (Viscosité, Tension Superficielle et Coulabilité en Métallurgie et plus Particulièrement en Fonderie). P. BASTIEN. *Rev. Fonderie Moderne,* Vol. 31, June 10, 1937, pp. 175-179. The terms are defined, their relation to the reactions that occur during melting and pouring, and to the properties of the cast metal are discussed. Ha (3)

The Testing of Solid Core Binders (Beitrag zur Prüfung weiterer fester Kernbinder) F. ROLL (Prüfamt Meier & Weichelt, Leipzig) *Giesserei,* Vol. 24, Jan. 1, 1937, pp. 9-11. Materials suitable for bringing agents in molding cores are discussed. Testing for purity and microscopic structure is described. 8 references. Ha (3)

3a. Non-Ferrous

2 **Elimination of Gaseous Impurities from Aluminum.** GEORGES CHAUDRON (Inst. Applied Chem., Lille) *Metal Ind., London,* Vol. 50, June 11, 1937, pp. 655-658. Original research. Extraction of gases in solid or liquid state even in very high vacua, has always been an extremely lengthy and incomplete operation. Previous work showed that successive heating in vacuo failed to remove all the gas from the Al. Therefore, it was assumed that liberation of gases was particularly difficult when the gases were leaving the metallic lattice and that a mass of metal could be imagined as being surrounded by a skin scarcely permeable to 3 gases. The hypothesis is advanced that if this potential barrier could be disturbed, the gases enclosed in the metal could be extracted rapidly. Bombardment in a discharge tube, in which the sample was the cathode, was employed. A low intensity discharge of a few milliamperes at 130,000 volts was used. The diffusion takes place cold, and not all the specimen need be exposed. The solubility of hydrides, carbonyls, and nitrides of Al increases with temperature. Overheating of Al and contact of combustion gases with the metal must be avoided. 8 references. 4 RWB (3a)

Non-ferrous Foundry Sand Control. G. K. EGGLESTON (Detroit Lubricator Co.) *Metal Ind., London,* Vol. 51, July 9, 1937, p. 40-44. See *Metals and Alloys,* Vol. 8, Oct. 1937, p. MA 606R/3. RWB (3a)

5 **What Shall a Die-casting Contain?** A. C. STREET. *Metal Ind., London,* Vol. 50, May 7, 1937, p. 531. Practical. Warns against die-casting too complicated parts, in particular the inclusion of small holes which could better be jig-drilled. RWB (3a)

Remelting Aluminum in the Foundry. H. RÖHRIG (Ver. Aluminium-Werke A.G.) *Metal Ind., London,* Vol. 51, July 2, 1937, pp. 5-8. General. Unlike the heavy metals Al is not readily refined and the tendency for the scrap supply is to increase. Approximately 46% of the total Al production in the 6 U. S. A. is scrap. The use of suitable fluxes cut the metallic losses on remelt. Oil and moisture cause considerable loss and should be removed before melting. Furnace atmosphere should be controlled. Dross incandescence indicates excess oxygen. The electric furnace is most advantageous for remelting. The molten bath may be degasified with Cl gas or chlorides. There is no other way of varying the composition of the melt than by adding pure Al. RWB (3a)

7 **Degasification of Aluminum Alloys.** G. MANN (Fairey Aviation Co.) *Metal Ind., London,* Vol. 51, July 23, 1937, pp. 89-90. Practical. Degasification of Al alloy melt with Al chloride resulted in improved physical properties and reduction in pinholing. The Al chloride was introduced into the melt by wrapping it in Al foil and pushing it to the bottom of the crucible by means of a plunger. Considerable evolution of gas follows. RWB (3a)

8 **An A.B.C. of Die Casting.** A. C. STREET. *Metal Ind., London,* Vol. 50, May 21, 1937, p. 578. Historical. RWB (3a)

An A.B.C. of Die Casting. Zinc Base Alloys. A. C. STREET. *Metal Ind., London,* Vol. 50, May 28, 1937, p. 600. General. RWB (3a)

9 **Soundness in Step Castings.** E. LONGDEN (Craven Bros.) *Metal Ind., London,* Vol. 50, May 21, 1937, pp. 579-583; May 28, 1937, pp. 603-604. Practical. Covers in detail the various steps required to produce a sound step bearing, of P-bronze, stressing the avoidance of porosity and blow-holes due to too low pouring temperature or gas evolution due to faulty molds. RWB (3a)

10 **Iron Mold for Lead Casting.** *Foundry,* Vol. 65, Mar. 1937, p. 74. Practical discussion of a tentative plan to use metal molds for casting hard Pb bearings. Pb is poured square flange up in split mold with plunger for forming center opening, working through hole in top of mold. Factors to be considered include approximate thickness of metal in mold walls; advantages and disadvantages in H_2O cooling; and character of material for coating mold. VSP (3a)

Brass Mold Reproduces Detail. *Foundry,* Vol. 65, Apr. 1937, pp. 51, 130. Discusses the reproduction of miniature railroad trains on a scale of ¼" to the foot. Castings usually are Al-base or Zn-base alloys. Gives details of production using sand molds. VSP (3a)

Babbitting Cast Iron, Steel and Bronze (Le Régulage des Fontes de l'Acier et du Bronze) J. NAPPÉE. *Mécanique,* Vol. 20, July-Aug. 1936, pp. 146-149. Practical. Babbitting common cast Fe is sometimes difficult owing to poor homogeneity of metal and to gas evolution during heating. To obtain good results (1) A special cast Fe containing very little gas should be used. (2) The surface should be cleaned by sand blasting or acid pickling. (3) The casting should be tinned by dipping process, temperature of process being accurately controlled. (4) Babbitt should be poured in the tinned casting. (5) The process should be facilitated by using a device which performs all above operations. No difficulties are met in babbitting bronze and steel. However, for bronze, the temperature of the process should be accurately controlled by pyrometers. An adherent babbitt coating must be aimed at; the layer may be thin if adhesion is good. FR (3a)

The Use of Charcoal in Casting of Copper Alloys (L'Emploi du Charbon de Bois en Fonderie d'Alliages cuivreux) R. J. KEELEY. *Rev. Fonderie Moderne,* Vol. 31, Apr. 10, 1937, pp. 110-112. A study of the action of charcoal in the melting of Cu alloys showed that it can prevent oxidation of the metal, deoxidize the metal, and introduce gases into the metal. When used in a crucible the charcoal should be placed on the bottom of the crucible before charging the metal. In an induction furnace, charcoal and metal are charged at the same time; it serves here merely as cover to prevent oxidation. As an electric arc furnace operates with a reducing atmosphere no charcoal need be used; in fact its use may be detrimental in those cases where the melt is susceptible to gas absorption. The conditions of use in different furnaces are discussed. Ha (3a)

Gates and Risers for Large Non-ferrous Castings. ADAM DUNLOP. *Foundry Trade J.,* Vol. 56, Feb. 25, 1937, pp. 177-180. Up-to-date review, covering bronze and high-tensile brass. The alloys useful in engineering practice contain up to 16% Sn. The most widely used bronze is the 88Cu-10Sn-2Zn Admiralty mixture. Zn has an effect somewhat similar to that of Sn when added to Cu, in that beyond the limit of the α solution it increases the amount of δ present. For practical purposes Zn is equivalent to half its amount of Sn in the production of the δ constituent. Shrinkage and contraction defects, dirty and misrun castings and different methods of gating are discussed. The composition of high-tensile brass is usually within the following limits:—Cu, 50-60; Sn 0-1.5; Fe, trace to 2; Al, trace to 3.0; Mn, trace to 4.0; Ni, 0 to 3.0% and Zn, remainder. The main obstacle to the production of sound castings is the great tendency of the molten metal to oxidize. AIK (3a)

Modern Lead Refinery. J. O. BETTERTON (Am. Smelting and Refining Co.) & H. P. WAGNER (Britannia Lead Co.) *Chem. Trade J.,* Vol. 100, Apr. 16, 1937, p. 336. Describes plant and processes of Britannia Lead Co., Ltd., Northfleet, Kent, England. Modified Parkes refining process is used. MS (3a)

Manufacture and Use of Lead Base Bearing Metals (Préparation et Emploi des Métaux Antifriction à Base de Plomb) RICHARD SCHMIDT. *Rev. Industrielle,* Vol. 66, Aug. 1936, p. 312. See *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 508R/7. FR (3a)

Pours Bronze Metal into Bull Ladle. *Foundry,* Vol. 65, Feb. 1937, p. 75. Practical discussion of casting a bronze casting weighing 1200 lb. in a shop usually engaged in smaller jobs. Considers pouring the metal from bull ladle and material used to line the ladle. VSP (3a)

A.B.C. of Die-casting. A. C. STREET. *Metal Ind., London,* Vol. 50, Jan. 8, 1937, p. 40. Practical discussion of the gravity die-casting of Al-bronze. At 12.4% Al the presence of the brittle delta compound makes the alloy valueless commercially. Well made die will cast 10,000 castings. Tensile properties of gravity castings are higher than those of sand castings. However the alloy has high shrinkage and care must be taken to avoid shrinkage cavities. It is not recommended to cast holes less than 5/32 in. diam., owing to likelihood of burning cores. Because of high shrinkage, the cored holes should be provided with a taper of about .015 in./in. The metal will electroplate readily and if desired can be directly Cr plated. It is hard to solder due to Al content. Soldering may be done with Ag or Al solder. RWB (3a)

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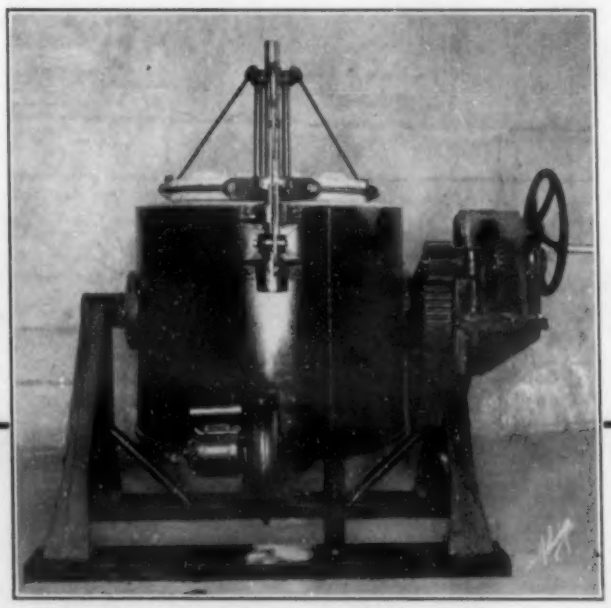

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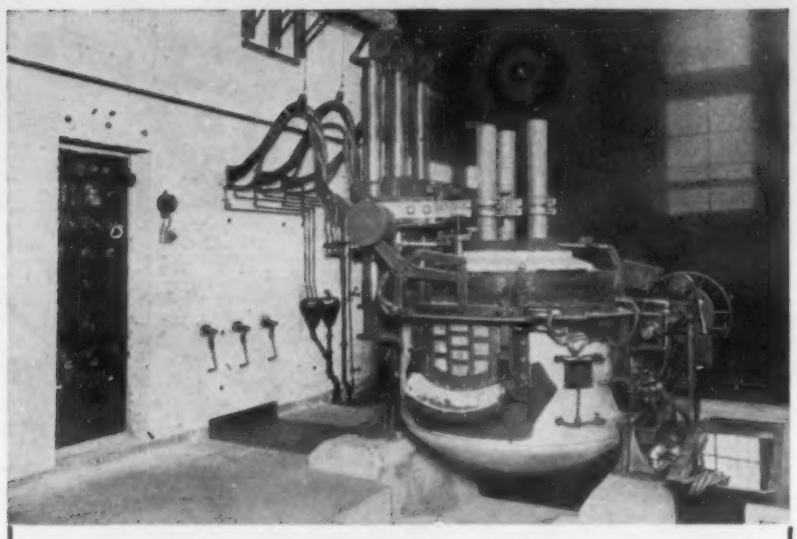

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3b. Ferrous

C. H. HERTY, SECTION EDITOR

1 **Causes of Scrapping Cylinders on Account of Shrinkage and Porosity of the Metal.** S. M. SKORODZIEVSKI. *Liteinoe Delo,* Vol. 8, No. 2, 1937, pp. 25-29. In Russian. On account of scrapping 40% of the total production of marine engine cylinders, an investigation was conducted which showed that the porosity and excessive shrinkage developed were connected with Si content dropping under 1.4%, but, as further checking failed to substantiate the conclusion, the defect was attributed to inherent properties of the iron. [This abstract really belongs in the "Chuckles" section. C. H. H.] (3b)

2 **Second Report of the Steel Castings Research Committee, Discussion, Correspondence and Committee's Reply.** *Iron Steel Inst.,* Special Report No. 15A, 1937, 36 pp. Discussion. Contains discussions and replies to Report No. 15, (see *Metals and Alloys,* Vol. 8, June 1937, p. MA 346R/5), published in 1936. JLG (3b)

3 **Slag Viscosity Control Affords Greater Uniformity in St...** C. H. HERTY, JR. (Bethlehem Steel Co.) *Steel,* Vol. 100, June 7, 1937, pp. 60-61, 64, 90; *Blast Furnace Steel Plant,* Vol. 25, Sept. 1937, pp. 1000-1001; *Iron Age,* Vol. 139, June 17, 1937, pp. 46-50. Describes the "VisControl" method of holding FeO in basic open-hearth slag within narrow limits by controlling fluidity and basicity of the slag. Composition of slag during melting period is determined qualitatively by measuring slag viscosity by means of a rectangular steel block with a well at one end and a ¼-in. hole, 10 in. long, extending from well to end of block. Composition of final slag can be predicted accurately provided that proper additions based on slag viscosity test are made. Resultant advantages are greater uniformity and cleanliness of steel, less waste of Fe in slag, and savings in limestone and deoxidants. MS + VSP (3b)

4

5 **What the Engineer Should Know about Cast Iron.** *Foundry Trade J.,* Vol. 55, Oct. 15, 1936, pp. 294-296. Mr. Roxburgh's presidential address to the Inst. British Foundrymen. Better melting facilities, sand improvement, high strengths, wear resistance, abrasion resistance of cast Fe, alloyed Fe, advance of austenitic Fe, etc., discussed. AJK (3b)

6 **Wear Resistant Cast Iron (Les Moulages en Fonte Résistant à L'Usure)** TONY BOISSAUX. *La Fonte,* No. 23, Sept.-Oct. 1936, pp. 877-884; No. 24, Nov.-Dec., pp. 914-925. Correlated abstract on the methods of producing cast iron for wear resisting purposes. Hardness obtained by the presence of hard constituents in a soft matrix may be cause of increased wear. Homogeneous hardness decreases wear. The action of various elements on the hardness of chilled cast iron is considered. 30 references. WHS (3b)

7 **Revamp Old Eastern Gray Iron Foundry.** PAT DWYER. *Foundry,* Vol. 65, May 1937, pp. 34-36, 122, 124. Describes plant modernization of the Builders Iron Foundry, Providence, R. I. VSP (3b)

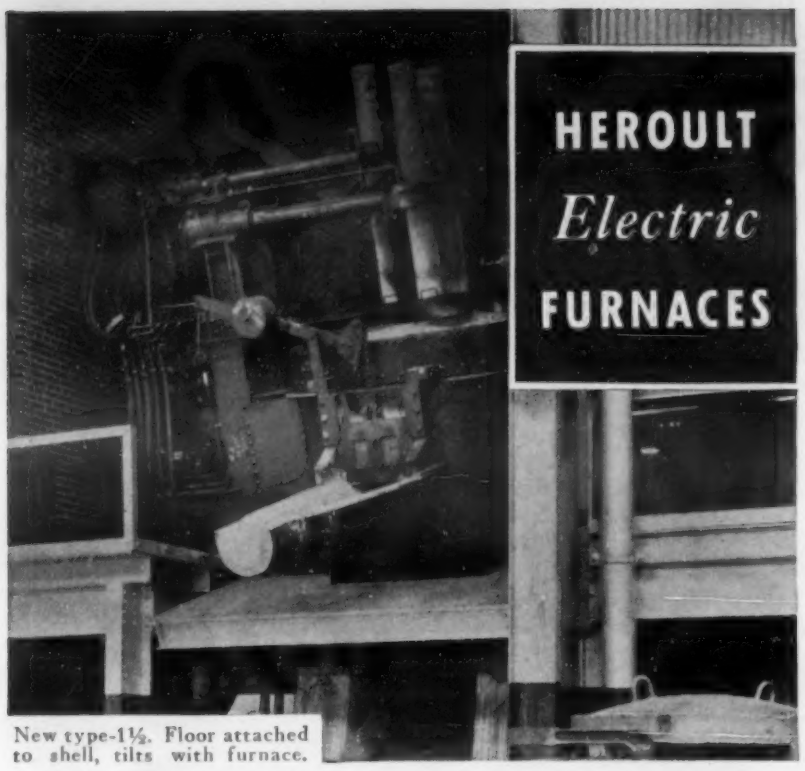
8 **Magnetic Moulding Machines.** *Engineering,* Vol. 143, Jan. 8, 1937, pp. 37-38, 40. Descriptive. A range of electro-magnetic molding machines of the squeeze-strip type for the rapid production of light castings on a repetition basis has been developed by Messrs. British Insulated Cables, Limited of Prescot, Lancashire, England. LFM (3b)

9 **Pressure Castings.** H. H. JUDSON (Gould Pumps Inc.) *Can. Chem. Met.,* Vol. 21, June 1937, pp. 222-224. Descriptive. See *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 70L/7. WHB (3b)

10 **The Effect of Non-metallic Inclusions on the Graphite Size of Grey Cast Iron.** A. L. NORBURY & E. MORGAN. *Engineering,* Vol. 143, Mar. 19, 1937, pp. 328-330. See *Metals and Alloys,* Vol. 8, May 1937, p. MA 270 R/4. LFM (3b)

Improvement of Castings Quality by Electric Melting: Steel Foundry (Amélioration de la Qualité des Produits de fonderie par la Fusion électrique: Fonderie d'acier) F. RENAUD. *Electricité,* Vol. 20, July 1936, pp. 242-249. Summarizes present knowledge on electric melting in steel foundries producing castings only. Studies various available electric furnaces and compares their value with that of furnaces which were used before advent of electric melting. Use of electric furnaces in steel foundry is discussed at length. Steels obtained are compared with those manufactured by non-electric melting. FR (3b)

Ohio Ferro-Alloys Corporation
Canton, Ohio



New type-1½. Floor attached to shell, tilts with furnace.

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1 **Machinable Magnet Steels of Great Rigidity Produced by Sintering Process.** *Automotive Ind.*, Vol. 76, Apr. 17, 1937, pp. 593-594. Digest of French Patent no. 799,798. Alloys containing Al may now be sintered. The Al_2O_3 that covers Al has prevented agglomeration in past methods. To remedy this a fragile Fe-Al alloy containing 50% Al is cast and powdered. This is added to Ni and Fe powders to give a mixture of 65% Fe, 25% Ni and 10% Al. After grinding together in a ball mill for 5 hrs., the powders are molded under pressure. Next they are sintered at 2,200-2,550°F. for 5 hrs. in a reducing atmosphere. The product is normalized at 1925°F. for 2 hrs. and air cooled. CMH (3b)

2 **Runner Basin Is Set Above the Mold.** *Foundry,* Vol. 65, Mar. 1937, pp. 35, 77. Practical description of special method used in casting of dryer shells, long, hollow cast Fe rolls. Castings range from 1 to 5 ft. in diam. and from 6 to 27 ft. in length. Thickness of heaviest wall is not more than 1 in. VSP (3b)

3 **Amorphous Graphite Lowers Chill and Hardness.** *Foundry,* Vol. 65, Feb. 1937, pp. 35, 90. Describes a new development in the control of chill and hardness in gray Fe castings. It is concerned with the addition of amorphous graphite to molten metal. Procedure shows a decided effect on reduction of chill, decrease in hardness, improved machinability and increase in total C content of various types of gray Fe. VSP (3b)

4 **Steel Castings for Stiff Service.** C. E. HERINGTON. *Foundry,* Vol. 65, Apr. 1937, pp. 50, 124. Practical discussion of the casting of pump casings and impellers, and also pipe sections by the Union Steel Casting Co. Total amount of metal employed, 674 tons. Analysis of the metal used was 0.40% C; 0.04% S; 0.04% P; 0.70% Mn; and 0.30% Si. VSP (3b)

5 **Liquidation in Centrifugal Casting.** G. KONANENKO. *Liteinoe Delo,* Vol. 8, No. 2, 1937, pp. 36-41. In Russian. Descriptive. Apparatus used for centrifugal casting of babbitt bearings is described. Centrifugal casting leads to pronounced liquation greatly affecting both microstructure and wearing qualities; the latter were determined in a series of experiments using Zitsev wear testing machine. (3b)

Electric Furnace Cast Iron. C. H. MORKEN. *Iron Age,* Vol. 139, Apr. 29, 1937, pp. 36-41; May 6, 1937, pp. 46-49, 120. General review of the electric furnaces used in foundries and their relative operating advantages. Compares electric and fuel fired Fe and making of wear, heat and corrosion resisting Fe. Tabulates chemical and physical properties of electric furnace Fe, and includes a number of photomicrographs. VSP (3b)

6 **The Temperature Measurement of Molten Steel by a W-C Thermocouple.** KIYOSHI SASAGAWA (Kure Navy Arsenal) *Tetsu-to-Hagane,* Vol. 23, Apr. 25, 1937, pp. 337-344. In Japanese. Original research. A W-C thermocouple which can be used especially for the measurement of casting temperature has been investigated. As the hot-junction of the thermocouple, W wire is attached inside a C tube, 6 mm. in internal diam., 15 mm. in external diam. and 800 mm. in length, a contact point being made by a C cap, and the hot-junction is dipped directly into molten steel without its protection sheath. The temperature is read with an ordinary millivoltmeter, as the value of E. M. F. obtained from this thermocouple is in the same order as that of a Pt, Pt-Rh couple. Hence personal error and the error of temperature measured can be greatly minimized. NS (3b)

8 **Mechanical Casting of Two-inch Cast Iron Pipe in Nine-foot Lengths.** A. W. CLAUSEN (McWane Cast Iron Pipe Co.). *Water Works & Sewerage,* Vol. 83, June 1936, p. 210. Method of centrifugel casting at controlled temperature is briefly described. Ha (3b)

Molding Methods for Cast Iron Strainers. J. H. LIST. *Mech. World Eng. Record,* Vol. 101, Mar. 7, 1937, pp. 456-466. Practical. Refers in detail to a job called for in oddments and carried out on the spindle. EF (3b)

9 **Chills on Drag Warp Castings.** *Foundry,* Vol. 64, Dec. 1936, pp. 35, 86. Describes the difficulties encountered in casting a gray Fe valve block for hydraulic lifts operating under 100 lb. pressure, and methods employed for obtaining satisfactory results. The analysis was C 3.42%, Si 2.38%, Mn 0.61%, P 0.176%, S 0.09%, Cr 0.38%, Ni 0.20%. VSP (3b)

10 **A Glance at the Steel Foundry (Un Coup d'Oeil sur la Fonderie d'Acier)** M. GUÉDRAS. *Rev. Fonderie Moderne,* Vol. 31, May 25, 1937, pp. 159-164. Survey of present conditions and practices in a steel foundry; in particular French conditions are discussed and the principles for producing good melts and castings defined. Ha (3b)

4. WORKING

Cold Working of Hollow Cylinders by Auto-frettage. N. E. WOLDMAN (Eclipse Aviation Corp.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 206-224. With discussion. General review. Theory and practice of the cold working of monoblock hollow cylinders, or tubes, by radial expansion methods known as "auto-frettage." 20 references. GEG (4)

Laws and Fundamentals of Plastic Deformation. A. V. DEFOREST (Mass. Inst. Tech.) *Trans. Am. Soc. Metals,* Vol. 24, Dec. 1936, pp. 783-788. General review. Before "laws and fundamentals" of plastic deformation can be set up adequate systematic correlation of all empirical data should be made. GEG (4)

Production of Seamless Iron and Steel Tubing and the Processes Involved in the Roll-piercing Process (Die Herstellung nahtloser Eisen- und Stahlrohre und die Vorgänge beim Schrägwalzen) HUGO SCHMID. *Montan., Rundschau,* Vol. 29, May 1, 1937, pp. 1-8; May 16, 1937, pp. 1-8; June 1, 1937, pp. 1-12. Reviews the development of the Mannesmann process for making seamless tubing and gives production figures for the U. S., Europe, and the Soviet Union. Contains a lengthy mathematical treatment of the forces involved in the process, with numerous graphs, diagrams, and tables. Discusses the following methods for making seamless tube: The Mannesmann process; the Briede process; the Stiefel process; the Swedish process; the continuous process; the Dietscher process; the Foren process; the Roeckner process (for large diameters). Various methods for hot and cold drawing are also taken up. BHS (4)

4a. Rolling

S. EPSTEIN, SECTION EDITOR

Production of Rolled Copper and Brass in London. *Metal Ind., London,* Vol. 51, July 16, 1937, pp. 55-60. Descriptive of methods of Enfield Rolling Mills, Ltd. RWB (4a)

Deformation Resistance During Cold Rolling Non-ferrous Metals and Alloys. I. M. PAVLOV & YA. GALLAY. *Metallurg,* Vol. 12, Mar. 1937, pp. 62-78. In Russian. Comprehensive mathematical and experimental study of factors involved in cold deformation of several metals and alloys. (4a)

Heavy Rolling Mill Work. *Electrical Rev.,* Vol. 120, Apr. 23, 1937, p. 607-609. Describes electrical drives and other equipment of various British heavy rolling mills. MS (4a)

Cooling and Finishing Plant for Rolled Products at Frodingham. *Engineering,* Vol. 143, Mar. 12, 1937, pp. 295-296; Rolling Mills at the Frodingham Works. *Iron Steel Ind.,* Vol. 10, Mar. 1937, pp. 291-296; *Blast Furnace Steel Plant,* Vol. 25, May 1937, p. 523-524; The Scunthorpe Steel Works, *Engineer,* Vol. 163, Mar. 12, 1937, pp. 311-312; Mar. 19, 1937, pp. 324-326. General description of the plant of Appleby-Frodingham Steel Co., England. LFM + CEJ +MS (4a)

Develops Slide Rule for Setting Strip Mill Roll Passes. H. C. GOODRICH (Carnegie-Illinois Steel Corp.) *Steel,* Vol. 100, May 24, 1937, pp. 59, 61. Describes operation of device for adjusting motor speeds and roll settings. Aids in determining the limitations and conditions of the mill for rolling various products. MS (4a)

Drives for Cold Strip Rolling Mills. W. B. GREEN (Brit. Thomson-Houston Co.) *Electrical Rev.,* Vol. 120, Apr. 23, 1937, pp. 616-617. Describes principal features of cold-rolling practice. MS (4a)

Unit Driven Roller Tables Improve Strip Mill Operating Efficiency. W. A. JAMES (Bethlehem Steel Co.) *Steel,* Vol. 100, May 10, 1937, pp. 57-58. Describes roller table drives used in mill of Bethlehem Steel Co., Lackawanna, N. Y., and their advantages. MS (4a)

Investigation of the Causes of Failure of Steel Rail Rolls. L. V. MONAKHOVA. *Teoria i Pract. Met.,* No. 1, 1937, pp. 65-74. Rolls in the plant investigated were somewhat brittle, breaking when running free or even in roll turning shop. Investigation is limited to the description of fractures observed. (4a)

The Cold Rolling of Mild Steel Sheets and Strip. A. HAYES & R. S. BURNS (Am. Rolling Mill Co.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 129-157; *Blast Furnace Steel Plant,* Vol. 24, Nov. 1936, pp. 984-988, 1008; Dec. 1936, pp. 1075-1078, 1110; *Steel,* Vol. 100, Jan. 11, 1937, pp. 37-39; *Sheet Metal Ind.,* Vol. 11, Jan. 1937, pp. 28-30; Mar. 1937, pp. 263-265, 308. Discussion of the mechanism for reduction by rolling, of the effects of front and back tension on the position of the no-slip point, and the effects of such tension on the metallurgy of the product and the power required to make reductions. The shape of stress strain curves before and after annealing indicates the effects of varying amounts of cold reduction. The elimination of yield point elongation is shown to be a function of the initial amount of yield point elongation, the diameter of the rolls used for tempering, and the surface of the sheet and the roller. Roller leveling and stretcher leveling are discussed. GEG + MS + AWM (4a)

Shot Blasted Cold Rolls Impart Dull Finish to Sheets. *Steel,* Vol. 100, May 3, 1937, pp. 82-85. Describes equipment installed at 48-in. strip mill of Weirton Steel Co., Weirton, W. Va., for shot blasting rolls used for cold reduction and skin passing. Rough roll surface produces a dull finish on sheet, which permits tighter gripping of dies in drawing and makes a more satisfactory foundation for surface finish. MS (4a)

Continuous Rod Mills Are Set Parallel in New Plant. *Steel,* Vol. 100, June 28, 1937, pp. 41-43. Describes mills of American Steel & Wire Co., Joliet, Ill. Each mill is served by a heating furnace. Each has a roughing train of 5 15-in. and 4 13-in. stands and a finishing train of 10 11-in. stands, with a flying shear between the trains. Throughout rolling, billet is changed at each pass from square to oval and back to square. Billet advances through all 19 passes in 75 sec. Instead of changing rolls, complete stands in finishing train are replaced. It is equipped throughout with anti-friction bearings. MS (4a)

Modern Rolls for Modern Mills. C. E. HERINGTON. *Iron Age,* Vol. 139, Apr. 1, 1937, pp. 50-51. Owing to rapidly increasing use of stainless and high alloy steels in a wide range of markets, certain definite changes in technique of roll making have occurred: Use of alloys to provide greater strength for heat and stress resistance; increased resistance to firecracking and wear; and "mirror finish" on roll surface to facilitate production of flawless surface on finished product. VSP (4a)

Runout Table Drives for Modern High-speed Wide Hot Strip Mills. W. R. HOUGH (Reliance Electric & Engineering Co.) *Steel,* Vol. 100, June 21, 1937, pp. 57-58, 60, 62. Comparative study, including tests, of the use of squirrel-cage induction-motors and d.c. motors for individual driving of conveyor-table rollers and coilers. Each type shows certain advantages, which should be weighed carefully before making a choice. MS (4a)

4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

Extrusion of Metals. D. K. CRAMPTON (Chase Brass & Copper Co.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 55-79. With discussion. Review of development of extrusion process. Hot extrusion, cold extrusion and impact extrusion of Pb, Sn, Cu, Al, Mg, Zn, Ni and their alloys are discussed, and extrusion pressures and temperatures are given. GEG (4b)

Some Aspects of Press Forging. J. H. HURST. *Metal Treatment,* Vol. 3, Spring 1937, pp. 3-7. Useful practical discussion. The flow of metal both at the surface and below it during press forging is considered. Experiments with ingots plugged with ball bearing markers and with drilled ingots illustrate the conclusion that the depth to which working penetrates depends on the tool surface and equals at least half the sum of its width and breadth. Forging pressures, grain flow, and the importance of uniform heating are discussed. JCC (4b)

Induction Heating Facilitates Forging and Swaging. *Iron Age,* Vol. 139, June 17, 1937, pp. 57-58. Practical discussion of new applications of induction heating being installed by Ajax Electrothermic Corp., namely, induction heating of end section of steel tubes prior to forging or swaging. VSP (4b)

On the Study of Methods of Forging Special Steels. YOSHIO SHIMOMURA (Osaka Army Arsenal) *Tetsu to Hagane,* Vol. 23, Jan. 25, 1937, pp. 11-23. In Japanese. Original research. In order to improve mechanical properties of special steels an investigation was made of various forging methods. The methods studied included "blind," "setting-in," and "internal pressure" forgings. The "setting-in" forging improves mechanical properties and homogenizes structure by giving ingot a "setting-in" in an early stage of forging, the proper quantity of "setting-in" being about 40% of the length of ingot. The internal pressure forging improves mechanical properties in the traverse direction and is especially effective for the forging of Ni-Cr steel ingots. In order to homogenize the structure of steels and to prevent the formation of flakes, the ingot, cast at relatively low temperature, has to be annealed for a long time and then the "setting-in" forging carried out. NS (4b)

Hot Press and Upset Forging. J. H. FRIEDMAN (The Natl. Machining Co.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 28-54; *Heat Treating Forging,* Vol. 22, Nov. 1936, pp. 550-553; Dec. 1936, pp. 610-613. With discussion. Description of recent improvements in both forging presses and upsetters. The importance of proper fiber flow and correct temperatures are stressed. GEG + MS (4b)

Continuous Extrusion of Lead Cable Sheaths. P. DUNSHEATH. *Mech. World Eng. Record,* Vol. 101, Jan. 22, 1937, pp. 77-78; *Electrical Rev.,* Vol. 119, Dec. 4, 1936, p. 783; Dec. 11, 1936, pp. 820-821; *Engineer,* Vol. 162, Dec. 4, 1936, pp. 609-610. A new development in the production of Pb cable sheaths is described, in which the pressure required to extrude the Pb is obtained by means of a motor-driven screw member instead of by a ram of a hydraulic press. The advantages attendant on the use of this continuous Pb extrusion machine are associated to some extent with the methods employed in melting the Pb and in the handling of the cable as it comes from the machine. EF + MS + LFM (4b)

Modern Hand Tool Manufacture. W. C. KERNAHAN (Staff). *Heat Treating Forging,* Vol. 23, July 1937, pp. 323-325. Describes forging, finishing, and heat treating equipment and methods at plant of the Vlchek Tool Company, Cleveland. MS (4b)

Recent Developments in Forging Plant. *Machinery, London,* Vol. 50, June 10, 1937, pp. 320-322. Practical. Vertical forging press and horizontal extrusion press are new developments. JZB (4b)

Forging Questions. L. T. WILLISON. *Am. Machinist,* Vol. 81, July 14, 1937, pp. 608-609. Correct design and proper heating for maintaining the properties of steel in the forging process are discussed and a table of temperatures at which various steels should be forged is given. Ha (4b)

4c. Cold Working — Shearing, Punching, Drawing & Stamping

Some Factors Affecting the Plastic Deformation of Sheet and Strip Steel and their Relation to the Deep Drawing Properties. J. WINLOCK & R. W. E. LEITER (Budd Mfg. Co.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 163-185; *Blast Furnace Steel Plant,* Vol. 25, Jan. 1937, p. 136; Feb. 1937, p. 236; Mar. 1937, pp. 332-333; Apr. 1937, pp. 438-439, 443; May 1937, p. 534-535. With discussion. The authors show how the occurrence of stretcher strains and the susceptibility to aging can be avoided by subjecting the steel to exactly the proper amount of cold work immediately before the deep drawing operation. Grain size and rate of deformation are shown to influence aging and also the formation of stretcher strains. GEG + MS (4c)

Cold Drawing Seamless Steel Tubes. H. C. KNERR (Metlab Co.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 114-128. Discussion of principles involved in producing cold drawn seamless tubing. Methods, equipment and tools are described and physical properties resulting from cold drawing are given. GEG (4c)

Cold Forming Processes—Drawing Rods and Bars. J. E. BECK (Jones & Laughlin Steel Corp.) *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 98-113; *Blast Furnace Steel Plant,* Vol. 25, Feb. 1937, pp. 208-210, 230-231; Mar. 1937, pp. 292-295. Description of cold drawing process as applied to plain C steel. Differences in processing practices affect the physical characteristics, machinability, finish, size accuracy, uniformity of section and degree of straightness. GEG + MS (4c)

Republic Steel Corporation's New Wire Mill. *Blast Furnace Steel Plant,* Vol. 25, May 1937, pp. 512-514, 536-537. **Republic's Wire Mill Discloses Advancement in Practice.** *Steel,* Vol. 100, May 3, 1937, p. 42-45, 94. Describes plant and equipment at Chicago, Ill., for manufacture of wire, nails, bail ties, and fencing. There are 11 wire drawing machines and a continuous electro-galvanizing unit with capacity of 40 strands of wire. MS (4c)

The Flow Processes in Cold Drawing of Contoured Samples of Various Materials (Der Fliessvorgang beim Kaltziehen von profilierten Stangen aus verschiedenen Werkstoffen) H. UNCKEL (Finspongs Metallverks, Sweden) *Z. Metallkunde,* Vol. 29, Mar. 1937, pp. 95-101. Research. Cu, Al, and brass samples with round, square, rectangular, and triangular cross sections were marked with contour lines on the surface and on symmetrical planes of sectional samples. The positions taken by these contour lines during reduction by cold drawing showed that the flow process differs with the type of material used. Equations are developed for calculating stress distributions within such cross sections with the help of experimental data on rates of drawing. GD (4c)

4d. Machining

H. W. GRAHAM, SECTION EDITOR

Machining of Light Metals with Carbide Tools (Bearbeitung von Leichtmetallen und deren Legierungen mit Hartmetallwerkzeugen) K. BECKER & B. GREF. *Leightmetall,* Jan. 1937, pp. 6-10. Practical. Detailed discussion of shapes, feeds and pressures to be used in drilling, sinking and grinding pure Al and Al-Si alloys containing up to 20% Si. FPP (4d)

Effective Use of Metal-cutting Tools. R. C. DEALE (E. W. Bliss Co.) *Mech. Eng.,* Vol. 59, June 1937, pp. 413-414, 448. **A Metal Cutting Test Method for Machine Shop Use.** *Iron Age,* Vol. 139, May 13, 1937, pp. 38-41, 114-115. A résumé of studies and experiments carried on by the A.S.M.E. Special Research Committee on Cutting of Metals in lathes, planers, shapers and other machine tools to effect greater economies. Formulas were derived for cutting speed for uniform tool life; for cutting speed as dependent on such variables as tool material, hardening treatment of tool, tempering treatment, cutting fluid, type of cut, etc., and for calculating the tangential cutting pressure. Constants are given. Ha (4d)

Factors Affecting Milling Speeds and Feeds. O. W. WINTER (Kent-Owens Mach. Co.) *Am. Machinist,* Vol. 81, May 5, 1937, pp. 375-380. The principal factors affecting milling operations, as material of cutter and that to be milled, depth of cut, coolant, etc., are discussed; tables are given showing speeds for different materials, and curves for selecting depth of cut and feed for different speeds and materials. Ha (4d)

Modern Tungsten Carbide Tool Manufacture. *Heat Treating Forging,* Vol. 23, June 1937, pp. 271-273. Description of new sintered carbide plant of the Firth-Sterling Steel Co., McKeesport, Pa. MS (4d)

Turning Operations on Aircraft Components. *Machinery, London,* Vol. 50, July 15, 1937, pp. 487-489. Practical. High output is obtained by using multiple tools on standard and special purpose machines. JZB (4d)

Machine Tool Exhibits at the Leipzig Fair. *Machinery, London,* Vol. 50, June 3, 1937, pp. 294-29. Description of automatic deep-hole drilling machine, double acting hydraulic drawing press, semi-automatic pipe cutting-off machine, electro-hydraulic upsetting machine, multi tool press and metal box making machine, optical dividing table, double column eccentric press, and small capacity honing machine. JZB (4d)

Turning 3-In. H. E. Sheels on No. 12 Rydermatic. *Machinery, London,* Vol. 50, June 3, 1937, pp. 292-293. Descriptive. JZB (4d)

Libby Heavy-duty Turret Lathes. *Machinery, London,* Vol. 50, June 3, 1937, pp. 290-291. Descriptive. Gives materials used. JZB (4d)

Special Machines for the Production of Rifle Barrels. *Machinery, London,* Vol. 50, June 24, 1937, pp. 395-399. Practical. Machine and process described. Co high speed bit welded to tubular shank is used. JZB (4d)

Machining a Stainless Steel Nozzle. *Machinery, London,* Vol. 50, June 3, 1937, pp. 287-288. Practical. JZB (4d)

5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

Heat-treating for Sustained Accuracy. D. M. GURNEV. *Am. Machinist,* Vol. 81, June 30, 1937, pp. 570-572. Survey. The different types of alloy steels used in the modern turret lathe and the layout of a heat-treating plant are described; a comparison of carburizing costs for the old pack method and for electric furnace-treatment is made. The latter is less expensive. Ha (5)

Some Observations on the Heat Treatment of Carbon Steels. A. G. ROBIETTE. *Iron & Steel Ind.,* June 1937, pp. 509-512. General. Comments on heating for forging and rolling, annealing, hardening and tempering. CEJ (5)

5a. Annealing

Controlled Atmosphere Furnaces for Annealing Tubes. *Ind. Heating,* Vol. 4, July 1937, pp. 541-542, 548. Descriptive. A furnace installation at the Republic Steel Corp., Cleveland, for normalizing electrically welded boiler tubing at 1650° F. to produce a scale-free surface, and at the same time a uniform structure and hardness is described. After annealing, the tubes are passed through a blueing furnace at 650° F. to obtain protection against rusting. Ha (5a)

5b. Hardening, Quenching & Drawing

Maintenance of Cyanide Hardening Baths. L. H. LEEDHAM. *Machinery, London,* Vol. 50, July 22, 1937, pp. 514-515. Practical. JZB (5b)

5c. Aging

The Cause of Temper Brittleness in Steels and Analogous Phenomena in Some Age-hardening Alloys. K. YOKOYAMA. *Nippon Kinzoku Gakukai-Si,* Vol. 1, May 1937, pp. 43 to 58; June 1937, pp. 92 to 103. In Japanese. Original research. Temper-brittleness in steels, according to Honda and Yamada, is due to the presence of carbides separating at the grain boundaries along the solubility line below the A_1 point. Several observed facts connected with temper-brittleness can be explained satisfactorily by the above theory, although there is no definite microscopic evidence for the boundary carbides in brittle specimens. Age-hardening in alloys also is a result of solubility changes. The two phenomena, therefore, are related to each other, and steels susceptible to temper-brittleness should show the aging phenomenon, while age-hardening alloys should have a property similar to the temper brittleness in steels. Temper-brittleness in steels could be dealt with as a property common to all alloys with varying solubility in solid solution. In some age-hardening alloys, the similarity to the mechanism of temper-brittleness in steels can readily be studied because (1) microscopic observations of the existence of compounds on the grain boundaries are possible and (2) the physical properties of such solid solutions are comparatively well known. In the first part of this investigation, the existence of both temper-brittleness and age-hardening was first confirmed in 3 C steels, 7 Ni-Cr steels, Cr steels, Ni steel, duralumin, Al-Cu alloys containing 5.5% Cu, 18-8 stainless steel and Corson alloy containing 4% Ni_2Si, by means of impact and hardness tests. The effect of the boundary compounds on the impact values of these alloys was examined microscopically as well as mechanically on the non-ferrous alloys and also on 18-8 stainless steel subjected to several kinds of heat treatments. The brittleness in these materials was due to the presence of the com-

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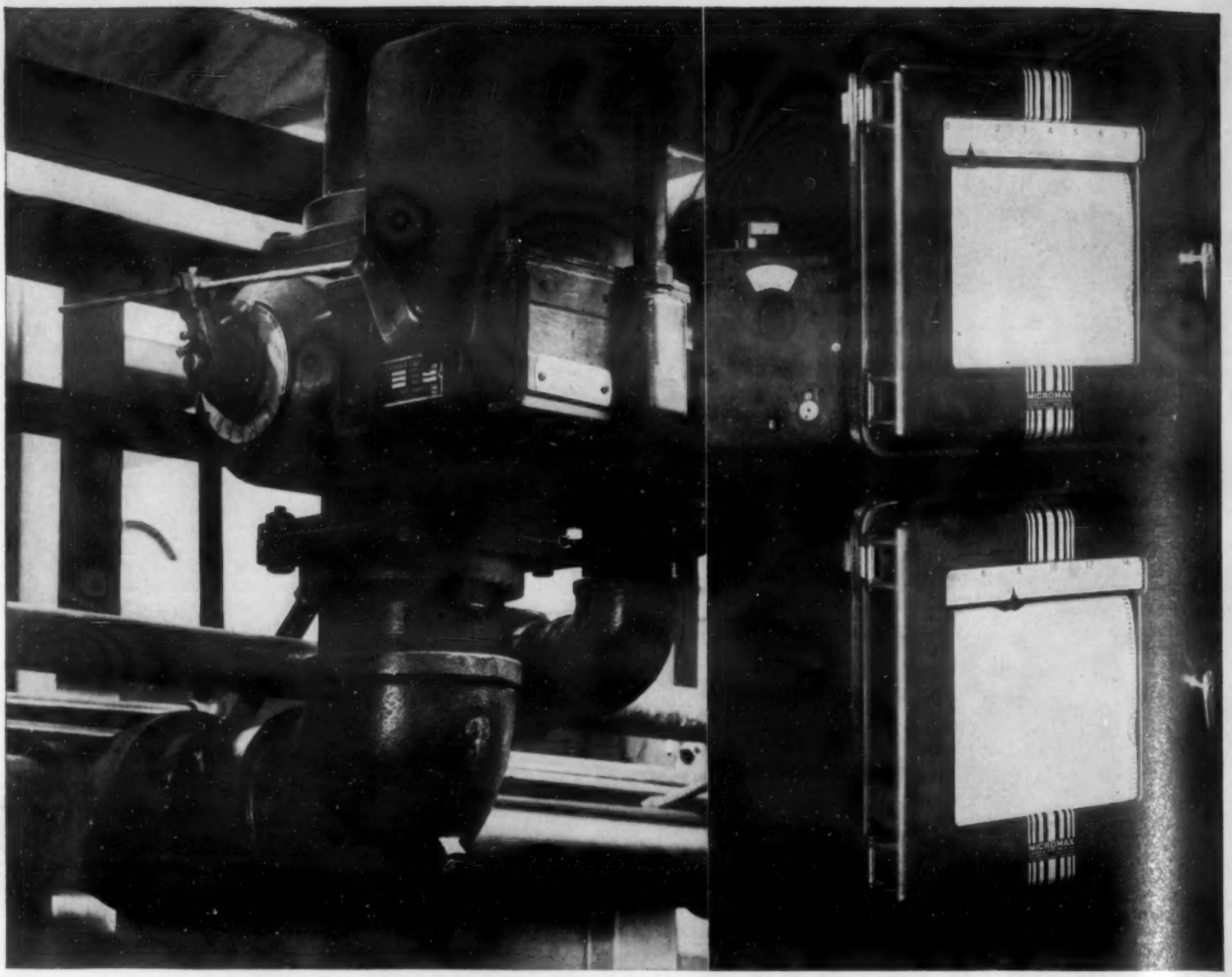

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J-NA(6)

MA 668

pounds on the grain boundaries. Thus the carbide theory on the temper-brittleness in steels was experimentally confirmed. In the second part of the investigation, the effect of the presence of solid solution phases separating at the grain boundaries on the mechanical properties of the alloys was also examined, microscopically as well as mechanically, with the age-hardening alloys, such as Cu-Fe alloy containing 1.31% Fe, Cu-Ag alloy containing 4.81% Ag and Fe-Cu alloys containing about 2% Cu. Experiments showed that there are two kinds of age-hardening alloys, (1) with or (2) without the properties similar to the temper-brittleness in steels, depending on the relation between the hardness of a phase separated out at the grain boundaries and that of the ground mass of the alloys; i.e., the Cu-Fe alloy with harder phase on grain boundaries is type (1) while the Cu-Ag or Fe-Cu alloy, with softer phase at the grain boundaries, is type (2). In the latter case the duralumin type of age-hardening does not occur in tempering. KT (5c)

5d. Carburizing

Influence of Preliminary Treatments on Graphitization of Black Heart Malleable Iron. G. TROITZKI & I. KVATER. *Metallurg,* Vol. 12, Feb. 1937, pp. 66-74. In Russian. Original research. A study of dilatation curves of white irons subjected to different heat treating operations showed the advantage of quenching or normalizing treatment as promoters of faster graphitization, owing to formation of additional nuclei of crystallization. These result from mechanical action exerted by metallic matrix on cementite at the transformation point. Smaller size of temper-C inclusions does not increase the strength of Fe. Quenching produces some indefinite changes, deleteriously affecting the strength of malleabilized metal. (5d)

5f. Nitriding

The Heat Treatment of Cast Iron, Nitrogen Hardening, Surface Hardening and Special Heat Treatments. J. E. HURST. *Iron & Steel Ind.,* Vol. 10, Feb. 1937, pp. 285-288, Mar. 1937, pp. 325-327. General review. See also *Metals and Alloys,* Vol. 8, June 1937, p. MA 354R/1. CEJ (5f)

6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

1 **The Work of the Coke Research Committees of the Iron and Steel Industrial Research Council.** E. C. EVANS & J. M. RIDGION. *Iron Steel Inst.,* Special Report No. 17, 1937, 62 pp. Committee reports. Section I is the foreword. Section II describes the Coke Research Committees. Section III discusses present position with regard to testing coke and methods of improving quality. Section IV gives detailed methods for testing coke. Section V considers improving coke by using different coals, blending, and by changing coking conditions. Part VI deals with variations in quality of Midland cokes. JLG (6)

2 **Graphite in the Metal Industry.** H. N. BASSETT (Egyptian State Railroad) *Metal Ind., London,* Vol. 51, July 23, 1937, pp. 87-88. General discussion of the forms and uses of graphite. RWB (6)

3 **Refractories.** R. S. HUTTON (Univ. Cambridge) *Metals Tech.,* Vol. 4, June 1937, T.P. 817, 16 pp. Institute of Metals Division lecture presented Feb. 1937. Discusses requirements for refractories in the metal industries, the properties of those available, and properties that are desired. The possibilities of developing economical super-refractories are considered. 80 references. JLG (6)

4 **Steel Company of Canada's Furnace Automatically Controlled.** CHARLES LONGENECKER (Staff) *Blast Furnace Steel Plant,* Vol. 25, July 1937, pp. 705-708. Describes 150-ton open-hearth furnace recently placed in operation at Hamilton, Ont. It is of the McKune type; is protected against dampness by a steel tank by which the regenerators are inclosed; is completely insulated; and is heated with a mixture of coke-oven and blast-furnace gas. Operation is largely automatic. Combustion is so controlled that flame is virtually non-luminous. MS (6)

5

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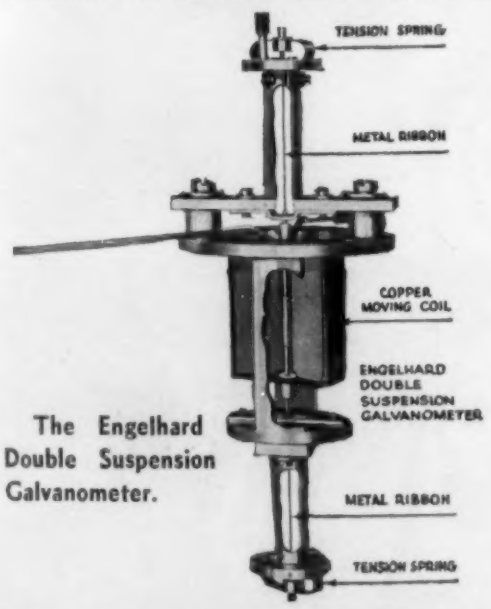

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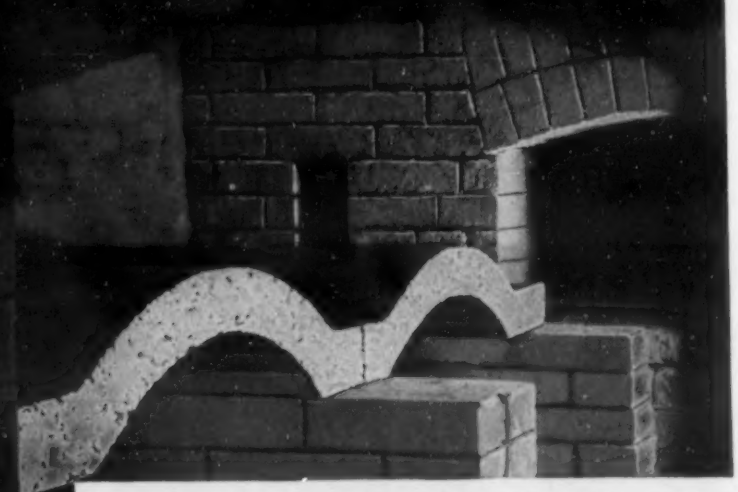

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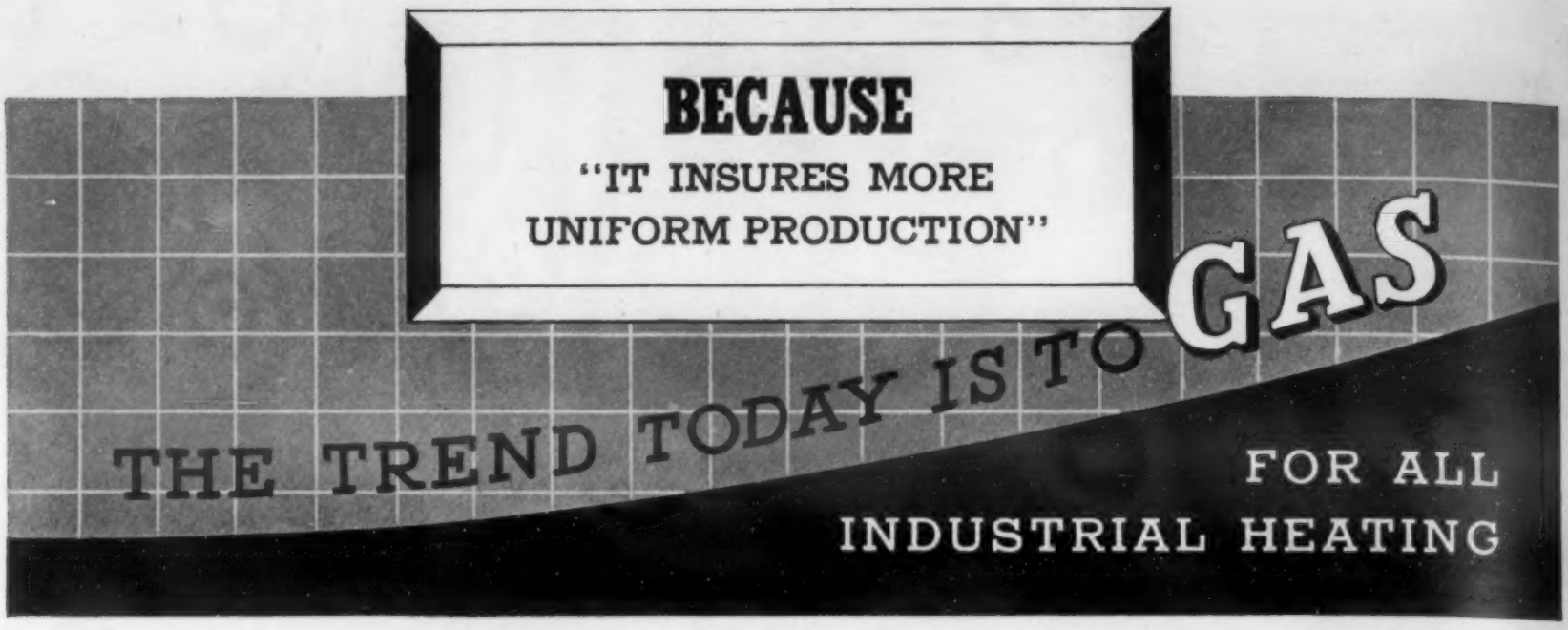

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Recent Electrically Heated Convection Heat Treating Furnaces for Light Metal Sheets (Ueber neuartige elektrisch beheizte Umluftvergüteöfen für Leichtmetallbleche). H. DICKS. *Elektrowärme,* Vol. 7, June 1937, pp. 117-122. Furnaces with air movement are described and compared with salt bath furnaces. Ha (6)

The Properties of Open-hearth Furnace Checker Bricks. T. SWINDEN & J. H. CHESTERS. *J. Soc. Glass Tech.,* Vol. 20, Dec. 1936, pp. 574-585. Original research. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 534R/2. Ha (6)

Refractory Material. J. H. PARTRIDGE (Gen. Elec. Co.) *Metal Ind., London,* Vol. 51, July 23, 1937, pp. 81-86; July 30, 1937, pp. 111-114. General discussion. See *Metals and Alloys,* Vol. 8, Jan. 1937, p. MA 18R/4. RWB (6)

Physical Characteristics of Coal. A. BEMENT. *Power Plant Eng.,* Vol. 41, May 1937, pp. 272-274. Efficiency of combustion and rate of burning are factors directly affected by size of coal; selection of proper size for specific plant involves consideration of stoker and furnace design and load carried on boiler. Efficiency and relative horsepower can often be increased by increasing size of coal used. ECK (6)

Pulverized Fuel Presents Operating Problems. MARK BELL. *Power Plant Eng.,* Vol. 41, Apr. 1937, p. 232. Discussion of operating problems giving maximum load variation for a single burner of 5 to 1. The fineness should be 80%-200 mesh with not more than 4% moisture for best operation. ECK (6)

Furnace Anneals Large Pulp Digesters. CARLETON CLEVELAND. *Heat Treating Forging,* Vol. 23, July 1937, pp. 355-356. Stress-relieving furnace at Birmingham, Ala., plant of the Chicago Bridge & Iron Company is 80 ft. long inside, 14 ft. wide, and 17 ft. high to crown of arch. Car bottom is floored with insulating concrete and insulating fire-brick and can carry 160-ton load. There are 15 Meehanite supports, on which charge is placed. Sides and arch are built up of insulating fire-brick and doors are lined with insulating concrete. There are 64 low-pressure type gas-burners, using coke-oven gas, divided into 12 groups, which are automatically controlled. MS (6)

The Celite Type High-temperature Thermal Conductivity Apparatus. C. E. WEINLAND (Johns-Manville Corp.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 8 pp. Brings up to date the description of this type of apparatus, four units of which are now in daily use for testing thermal insulation at temperatures up to 1600° F. The present method of constructing heater plates is described, as is also the assembly of the apparatus with metallic isothermal plates, and heaters for the "cold" faces of the test samples, all of which are modifications introduced since the previous description was published (*Proc.* A.S.T.M. Vol. 28, Pt. II, p. 820, 1928). A simplified arrangement of the thermocouples is now used, and for electrical power measurement a wattmeter circuit is described which provides wattage readings over an extended range on a large number of power circuits, with the elimination of certain troublesome circuit errors and with the minimum of instrumental equipment. The method of conducting the test makes possible results in a form approximating the mathematical concept of conductivity, with attendant advantages in the use of the results in heat-loss calculations. Typical test results and calculations are shown. VVK (6)

Equipment for Annealing Copper Without Oxidation. *Machinery, N. Y.,* Vol. 43, May 1937, pp. 581-582. Describes a gas-fired furnace for annealing Cu at about 1000° F. with a special atmosphere of cracked coke-oven gas. Capacity 3000 lbs./hr. A special cooling chamber is provided down to 150° F. before the work comes into contact with air. Ha (6)

New Applications Are Developed for Electric Induction Heating Process. *Steel,* Vol. 100, May 31, 1937, p. 76. Describes induction heating equipment developed by Ajax Electrothermic Corp., Trenton, N. J., for heating metal prior to forming and forging operations. MS (6)

Hardening Miscellaneous Small Components in Continuous Furnaces. E. E. HALLS. *Machinery, London,* Vol. 50, June 17, 1937, pp. 352-353. Practical. Comparison of relative efficiency, with regard to uniform quality and decarburization, of batch furnaces, and of continuous rotary hearth or conveyor furnaces. Latter have many advantages. JZB (6)

Enlarged Electric Heat Treating Facilities Bring Advanced Practice. *Steel,* Vol. 101, June 26, 1937, pp. 62-64. Describes warm-up oven and 4 belt-type car-bottom furnaces recently installed in heat treating shop of Bethlehem Steel Co., Bethlehem, Pa. All quenched bars are placed in warm-up oven immediately after removal from quenching bath. Oven resembles a pit furnace, and has inside dimensions of 7 ft. width and 7 ft. 2 in. length and capacity of 50,000 lbs. of bars per 24 hrs. Tempering or annealing operations are carried through to completion in the car-bottom furnaces, which are 27 ft. in length and vary in other dimensions. Auxiliary cooling system performs its function under same accurate control and with same uniformity incorporated in provisions for heating. Controlled gas atmospheres are used. MS (6)

Mineral Formation between Dolomite and Open-hearth Slag. B. PINES & G. KUSHTA (Ukrainian Inst. Refractories) *Stal,* Vol. 6, July 1936, pp. 47-59. In Russian. Original research. Crushed dolomite mixed with 5-55% open-hearth slag was compressed and heated to 1380° to 1650° C. Mixtures containing less than 20% slag formed 2 $CaO.SiO_2$, 2 $CaO.Fe_2O_3$, and free MgO and CaO. Mixtures containing over 20% slag formed 2 $CaO.SiO_2$, 2 $CaO.Fe_2O_3$, free MgO, and a solid solution of $MgO.Fe_2O_3$ and $MgO.Al_2O_3$. The lattice parameter of the solid solution increased with an increase of slag content, showing an increase in the Fe content of the solid solution. HWR (6)

Coke Research. W. DAVIDSON. *Blast Furnace Steel Plant,* Vol. 25, May 1937, pp. 499-502, 511; June 1937, pp. 630-631. See *Metals and Alloys,* Vol. 7, Oct. 1936, p. MA 496R/8. MS (6)

Electric Rocking Furnace. A. J. G. SMITH. *Electrical Rev.,* Vol. 121, July 9, 1937, p. 45. Gives advantages of rocking furnace, details of construction of Russ type, and total melting costs per ton in Germany. Cost per ton for Cu alloys (up to 85% Cu) is £1 9s.9d.; Ni alloys, £2 5s.3d.; electric gray Fe, £2 18s.9d., and duplexing, 13s.5d. MS (6)

Electric Heat in the Foundry. A. J. G. SMITH. *Electrical Rev.,* Vol. 120, Mar. 19, 1937, p. 426. Describes vertical elevator oven used in Germany for drying cores. They are first elevated and then lowered through a double heating chamber, drying being assisted by forced air circulation. Presents also charts showing energy consumption per ton for melting various non-ferrous metals in induction and arc furnaces. MS (6)

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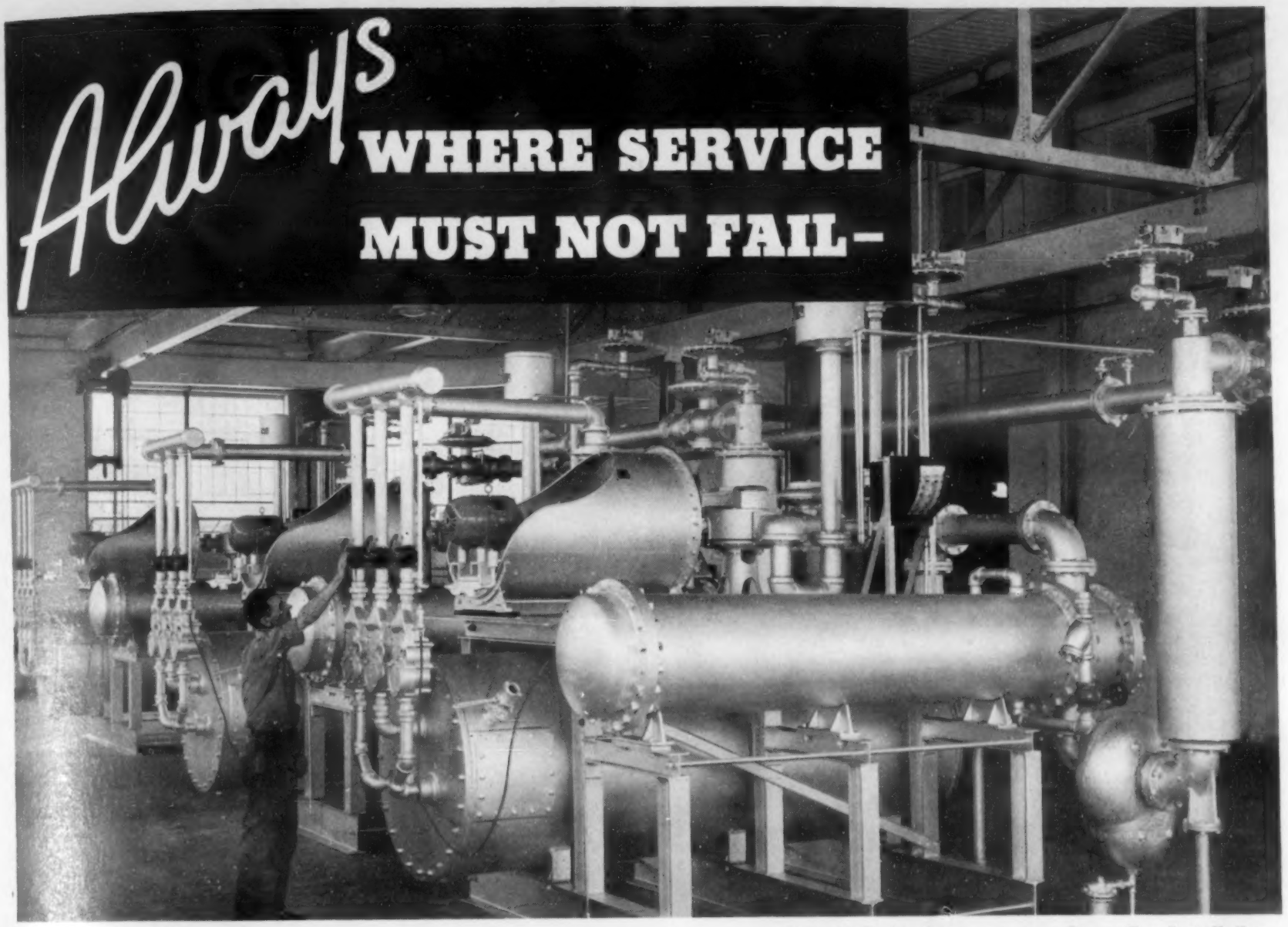

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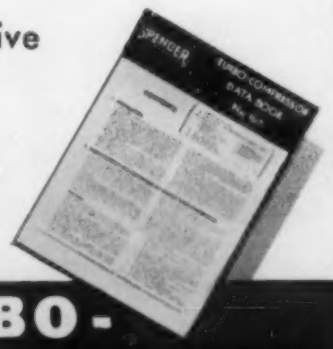

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7. JOINING

7a. Soldering & Brazing

C. H. CHATFIELD, SECTION EDITOR

Effect of the Oblique Joint on the Impact Resistance of Copper. MINORU OKADA & SINZO KAWAI. *Yosetsu-Kyokwai-Shi,* Vol. 7, May 1937, pp. 203-211. Cu pieces were resistance-welded with Tobin bronze at several angles to the longitudinal direction of the pieces, and the impact value of the welded parts determined. If the oblique joints are at an angle less than 32° they offer good impact resistance but the joints at an angle of more than 32° break easily on the welded faces. HN (7a)

7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

Consumption and Times for Oxy-acetylene Welds (Consumi e tempi per la saldatura ossiacetilenica) C. M. *Ind. Meccan.,* Vol. 19, May 1937, pp. 295-299. Tables are compiled showing each procedure of welding illustrated by diagram and photograph, dimension of weld, time used for 1 meter length and consumption of O and acetylene in liters/meter and of wire in g./m. Fields of application are given. Ha (7b)

Autogeneous Cutting of St52 (Autogenes Schneiden von St52) R. DÜMPELMANN (I. G. Farbenindustrie) *Autogene Metallbearbeit.,* Vol. 30, July 1, 1937, pp. 219-223; Sept. 1, 1937, pp. 289-296. Original research. A sheet of structural steel (1000 x 2000 x 10 mm.) with 0.12% C, 1.0% Mn, 0.62% Si, 0.26% Cu, 0.04% Ni, 0.00% Cr, 0.098% P and 0.024% S was cut autogeneously into a great number of samples and tested. All samples had a smooth, neat cutting face and showed no deterioration of tensile strength, hardness, bending and notch-impact strength of the original metal. Ha (7b)

Some Important Problems of Welding Discussed at the Last International Congress for Bridge Building and Architectural Engineering (Einige wichtige auf dem letzten Internationalen Kongress für Hochbau und Brückenbau behandelte Fragen der Schweisstechnik) G. BIERETT (Staatl. Mat. Prüf. Amt, Berlin) *Elektroschweissung,* Vol. 8, May 1937, pp. 81-85; June 1937, pp. 113-115. Useful review. HR (7b)

Oxy-acetylene Welding of Sheet Metals. C. G. BAINBRIDGE (British Oxygen Co.) *Welding J. N. Y.,* Vol. 16, Apr. 1937, pp. 14-17; *Sheet Metal Ind.,* Vol. 11, Feb. 1937, pp. 217-220. See *Metals and Alloys,* Vol. 8, Aug. 1937, p. MA 490L/8. WB + AWM (7b)

Time Control Solves Spot-welding Problems. *Welding Engr.,* Vol. 22, June 1937, p. 25. Discussion of successful spot welding of non-ferrous metals using Ignitron timer. The various metals spot welded to each other and spot welded to other metals are given in two tables, showing number of cycles, machine capacity used, tip pressure for various thickness on a 100 Kva machine. Samples all tested to produce a tear in parent metal at least 3/16" diam., for an electrode tip of ¼ in. diam., in order to pass inspection. The various samples tested are shown in photographs. WB (7b)

Theory of the Resistance Welding Circuit. L. H. FROST. *Welding Engr.,* Vol. 22, June 1937, pp. 32-33. Clear review of equations pertaining to heat developed at contacting areas from which it is concluded that time is most important single variable with current next in importance. Other variables are the materials to be welded and condition of surfaces (oxides, films, etc.). 18-8 requires less current than mild steel when welded with Cu electrodes owing to higher resistance of stainless. WB (7b)

Characteristics of Arc Welding Machines. S. G. P. DE LANGE. *Engineer,* Vol. 163, Mar. 12, 1937, pp. 295-296. Descriptive. Gives a routine procedure by which all welding machines can be judged and which has technical value and can be applied in all similar cases. Use is made of movie film taken at a speed of 4000 images/sec. which shows in slow motion the transfer of the molten metal. The oscillogram is important in judging a welding plant as it gives a true picture of voltage and current changes down to the smallest detail. LFM (7b)

Welded Joints in Pressure Vessels. STANLEY FABES DOREY. *J. Inst. Civil Engrs.,* Vol. 4, Apr. 1937, pp. 621-686; *Welder,* Vol. 9, Mar. 1937, p. 92; *Welding Ind., London,* Vol. 5, Mar. 1937, pp. 59-62; Apr. 1937, pp. 98-102; *Sheet Metal Ind.,* Vol. 11, Apr. 1937, pp. 393-396, 392. General review. The welding of pressure-vessels is considered from the points of view of design, workmanship, material, welded joints, joint efficiencies, procedure control and testing of welded joints, heat treatment, and X-ray examination. JWD + WB + AWM (7b)

Lengthening a Steel Tanker. *Welding Engr.,* Vol. 22, June 1937, pp. 15-16. Description of lengthening of 115 ft. tanker to 145 ft. by cutting all welded ship in two and adding the 30 ft. by welding in 22 days. WB (7b)

For Welding Long Sheets Together. *Steel,* Vol. 100, June 28, 1937, p. 47. From *Nickelsworth,* published by International Nickel Co. Device consists of a steel wedge with steel plates welded on both top and bottom. Sheets to be welded together are inserted in openings between plates. Wedge allows contraction of welded metal to pull sheets together. Steel block welded to top plate is used as handle to drive wedge along seam. MS (7b)

Hard-facing Welding Process for Renewing Worn Machine Parts. *Engineering,* Vol. 143, Mar. 26, 1937, p. 343. Descriptive. This new process has been developed by Messrs. Barimar, Limited, of London. The deposit from the weld feed rod air hardens without further treatment. Either the oxy-acetylene or electric welding process can be used. In the former, uncoated rod and a separate flux are used with a slight excess of acetylene in the flame which makes it slightly carburizing. In the electric process the rod is coated with asbestos and the work is made the negative pole. It is claimed that the weld metal retains its hardness at 1250° F. The process can be used on steel or cast Fe. No analysis of the feed rod is given. LFM (7b)

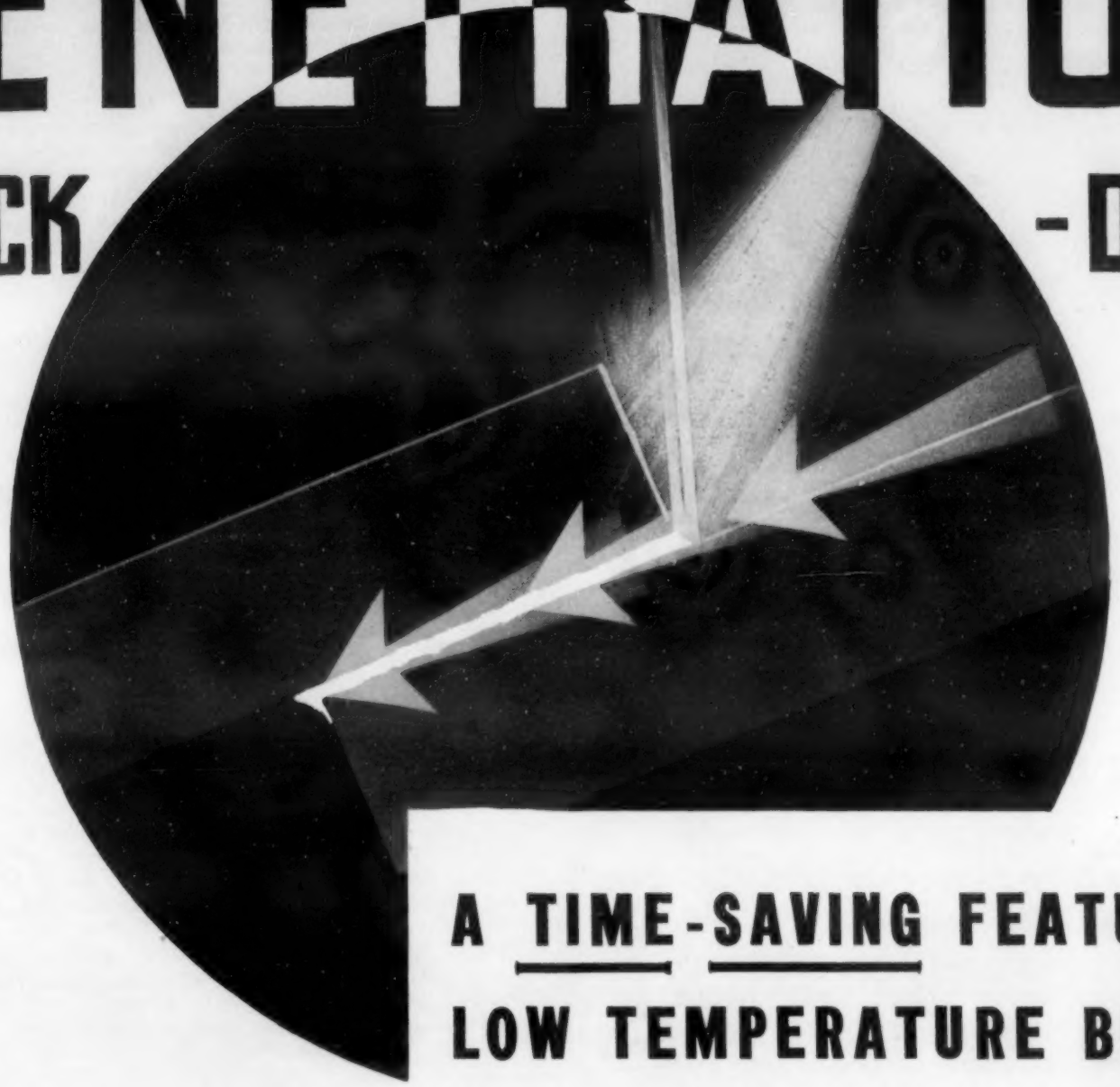
Flexible Tubing from Strip. *Iron Age,* Vol. 139, May 13, 1937, pp. 60-61. Describes method of producing flexible metallic tubing from strip by means of autogenous welding developed by the Chicago Tubing & Braiding Co. Tubes may be made from Monel, bronze and steel. Bronze must be free from Zn. Gives results of hydraulic tension tests. VSP (7b)

Radiographic Examination of Welds. V. E. PULLIN. *Welding Ind., London,* Vol. 5, Apr. 1937, pp. 104-114; discussion pp. 115-117. Unusually comprehensive review. Subjects covered are porosity, slag inclusions, cracks, lack of penetration, contrast, definition as affected by scattering. The A.S.M.E. rule on acceptable porosity radiographs is criticized as intending to imply that the interpretation of the radiograph need not be made by an expert. Quantitative measurements of porosity are described as a remote possibility as a laboratory tool, but impractical for industrial use. Specific gravity figures from radiograph intensity values are also impossible since the intensity of the film depends not only on depth of flaw, but also its width, and scatter is different for exactly similar flaws occurring at different positions in the plate. A number of radiographs are shown which indicate porosity due to slag, gas and flaws due to cracking; these differences are detailed for the various films taken. [A great many of the photos showing radiographs are impossible for the reader to interpret due, apparently, to poor reproduction.] The discussion brings out a few additional points in which it is shown that two radiographs may be exactly similar as regards porosity, but the density obtained in one case may be due to scattered areas of porosity, while in the other it may be due to concentrated porosity which would have entirely different effects on the properties of the weld. It is indicated that Lloyd's Register may drop the specific gravity requirement since acceptable weld radiographs were found never to be less than 7.8. WB (7b)

Investigation of Arc Welding Flux. T. FUKUDA. *Yosetsu-Kyokwai-Shi,* Vol. 7, May 1937, pp. 212-222. In Japanese. Welding fluxes are classified into 3 groups according to the amount of blow holes found in welds produced by electrodes coated with each. Borax, sodium carbonate, silicate cotton, MnO_2, fluorspar, silica, etc., were studied. The more fine-grained the flux, the fewer blow holes are produced, and consequently the fatigue limit of welded pieces are improved. To get a superior-coated electrode, the mixed flux must contain more than 70% of the non-blow hole-forming constituents. HN (7b)

PENETRATION

QUICK -DEEP



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1 **Stress Distribution in Fillet Welds—A Review of the Literature to Jan. 1, 1937.** A. G. SOLAKIAN & G. E. CLAUSSEN. *Welding J., N. Y.,* Vol. 16, May 1937. Supplement pp. 1-24. Formulas for calculation of stresses are reviewed and evaluated from prediction of accuracy of stress concentration factors in literature. Experiments on stress distribution are cited and results assembled in tabulated data, sketches and curves. 150 references. WB (7b)

— **Arcatom Welding of Light Metals (Die Arcatomschweissung von Leichtmetallen)** F. ROSENBERG. *Aluminium,* Vol. 19, Apr. 1937, pp. 255-260. The arcatom process (using the electric arc within a protecting gas envelope) has proved to be very advantageous for light metals because of its conocentrated heat. The method stands midway between ordinary arc and oxy-acetylene welding, the latter being still the best as regards temperature drop transversely to the seam. Ha (7b)

— **Steel Which Won't Weld.** J. S. GLEN PRIMROSE. *Edgar Allen News,* Vol. 15, Apr. 1937, pp. 1-2. The reason that a certain steel was found unweldable was previous overheating. After normalizing the steel it could easily be welded by forging under the hammer. Ha (7b)

— **Fusion Welded Pressure Vessels.** H. HARRIS (Babcock & Wilcox, Ltd.) *Elec. Times,* Vol. 91, June 3, 1937, pp. 773-774. Brief notes. Welding is used for boiler drums working up to 950 lbs./in.^{2} and is ideal for butt-joining steam piping systems, although their inspection by X-rays is not possible. JCC (7b)

4 **Longer Life for Diesel Valves.** R. K. KENNEDY. *Power Plant Eng.,* Vol. 41, May 1937, pp. 281-283. Detailed directions are given for Stelliting valves and valve seats. Service records given show a great increase in life of valves and valve seats due to Stellite. ECK (7b)

— **All-welded Blast Furnace Stove Operated at English Plant.** H. M. HENDERSON (Appleby-Frodingham Steel Co.). *Steel,* Vol. 101, July 12, 1937, pp. 65, 67. Describes erection of an all-welded stove at Appleby works of the Appleby-Frodingham Steel Co., Ltd., Scunthorpe, Lincolnshire, England. MS (7b)

5

— **Low Alloy Steel Selection—The Weldable Nickel-copper Steels.** ALBERT WILLIAMS (Wellman Engineering Co.) *Ind. & Welding,* Vol. 10, May 1937, pp. 34-36. High yield and ultimate strength along with low hardenability is stressed for the Cu-Ni-Mo steels. Table gives properties of welded sections as welded and as heat treated. WB (7b)

6 **Torch-carrying Divers at Bonneville.** HENRY W. YOUNG. *Welding Engr.,* Vol. 22, Mar. 1937, pp. 20-21. Various general

— uses of underwater cutting torch described. . . WB (7b)

Welding and Erecting 150-Foot Stacks. F. L. WURST. *Welding Engr.,* Vol. 22, Mar. 1937, p. 19. Descriptive. WB (7b)

7 **Types and Fields of Application of Electric Seam Welding Machines (Bauarten und Anwendungsgebiete elektrischer Nahtschweissmaschinen)** H. WILBERT (Siemens-Schuckertwerke) *Siemens-Z.,* Vol. 17, Feb. 1937, pp. 74-78. Machines developed

— especially for welding thin sheets, and best procedures and arrangement of welds are described. Ha (7b)

8 **Correct Shape of Welding Tables (Zweckmässige Gestaltung von Schweisstischen)** F. STRACHE. *Autogene Metallbearbeit.,* Vol. 30, May 15, 1937, pp. 153-154. Descriptive. Ha (7b)

— **All-welded Shop Constructed for Barge Assembly.** EDWARD H. SYKES. *Welding Engr.,* Vol. 22, Apr. 1937, pp. 17-18. Descriptive. WB (7b)

9 **Welded Road Transport Tanks.** E. W. ELDIN. *Welder,* Vol. 9, Apr. 1937, pp. 117-119. Descriptive. Tankers of mild steel, low alloy steels, Staybrite, Al and alloys, Ni and alloys, Cu and coated metals are fabricated by welding. Tanks carry conc. H_2SO_4, alkalis, HCl with inhibitor, petroleum and products, milk, beer,

— vinegar, glucose, etc. WB (7b)

10 **Spot Welders Synchronized for Profit.** WILLIAM BARBOUR (Raytheon Prod. Corp.) *Mill & Factory,* Vol. 20, Mar. 1937, pp. 66-68. Descriptive. Failure of small welders on same power line as large to function properly because of occasional simultaneous firing was overcome by use of group of synchronous drives in place of induction motor belt drives. Equipment is described. FPP (7b)

Strain Measurements in Welded Joints. J. L. BRANVILLE & H. A. STORRS. *Welding J., N. Y.*, Vol. 16, June 1937, Supplement pp. 1-4. Original research. In order to avoid the uncertainty of the bend test in measuring ductility of welded joints the authors developed a method of determining elongation of the weld metal in welded joints with loads applied up to the breaking stress. A special test piece is prepared from a 1½" strip cut transverse to weld and the cross section of the weld, centrally placed in the strip, is reduced by drilling out 3 holes 3/16" diam. in the weld metal. One hole is in middle of weld length of 1½ in. and is measured for elongation in pull direction during tensile test, the measuring device being a graduated wedge scale pushed into the hole from both sides. The results of such tests are described, tabulated and plotted. The presence of the hole in the sample tested for elongation by the wedge method is a disturbing factor in determining unit stress of the weld metal; therefore although the load at the yield and ultimate are known, the corresponding stress in terms of lbs./in.^{2} cannot be determined at present. A correction factor is necessary for the latter; the desired correction factor varies with the applied stress, and is therefore not constant. Tests are tabulated showing the apparent increase in unit strength due to presence of increasing diameter of center hole of 1½ in. strip of unwelded plate. WB (7b)

Considerations on Welding of Railroad Rails (Considérations sur la Soudure des Rails de Chemins de Fer) ANDRÉ DELANOY. *Bull. Soc. Ing. Soudeurs,* Vol. 7, May-Aug. 1936, pp. 2181-2193. Descriptive. Gives details on alumino-thermic welding method which is said to be used more and more in France and elsewhere for joining rails. The method is very convenient and requires few appliances or tools. Butts are preheated by means of a gasoline flame. Alumino-thermic welding methods are suitable in the following cases: (1) for making long bars, (2) for reclaiming old rails to make bars of normal length, (3) if rails lie in tunnels, (4) if rails lie on bridges, (5) if rails are secondary lines or station rails. Impact test that is quite adequate for judging quality of rails may not be suitable to evaluate welded joints on rails. Although it is believed in France that welded joints on rails are improved by an annealing treatment, the value of such treatment is discounted in Germany. FR (7b)

Modern **Method of Oxy-acetylene Welding Compared to Arc Welding (Les Méthodes Modernes de Soudure Oxy-acétylènique vis-à-vis de la Soudure Électrique à l'Arc)** R. MESLIER. *Rev. Soudure Autogène,* Vol. 28, July-Aug. 1936, pp. 16-19. *Bull. Soc. Ingénieurs Soudeurs,* Vol. 7, May-Aug. 1936, pp. 2217-2226. Compares value of oxy-acetylene and arc welding methods for various typical cases and concludes that when correctly used the first can be superior to the second in some instances. Each method has its awn field of application. See also *Metals and Alloys,* Vol. 5, July 1934, p. MA 337. FR (7b)

New **Sectional Framework for Building Construction Is of Welded Steel Rods.** J. EDW. TUFFT. *Steel,* Vol. 100, Mar. 22, 1937, pp. 44, 46. Describes system, devised by A. M. McLellan, in which mild steel rounds are frame members. Less than 70 tons of electrically welded rods, ¼, ½, and ¾ in. in diam., were required for frame of 68 x 132 ft. church and adjacent tower, both 50 ft. high, in Culver City, Cal. MS (7b)

Experiments on Welded Structural Members Made from Material Cut by Shears and by Torch (Versuche an Schweisskonstruktionen unter Verwendung von autogen gebrannten und mit der Schere geschnittenem Material) L. TETZLAFF. *Schiffbau, Schiffahrt u. Hafenbau,* Vol. 38, Feb. 1, 1937, pp. 34-40. Original research. Testing results presented in a large chart and 12 illustrations prove that there is practically no difference in tensile strength between welded structure made from sheets which were cut in shears on one hand and cut by torch on the other hand. However, gas cutting yielded greater bending strength and ductility. EF (7b)

Oxy-acetylene Welding Practices in the Metal Mining Industry. H. R. WASS (St. Joseph Lead Co.) *Mining Cong. J.,* Vol. 23, May 1937, pp. 89-90. Review. Mining companies have been welding permanent pipe lines for years. Flanges and flanged fittings are used only where absolutely necessary. Welding and flame cutting are widely used to salvage damaged lines and to rehabilitate economically other (large) equipment; hard facing of parts subject to heavy wear and abrasion will triple their useful life. Some metallurgical mining companies have as many as 50 oxy-acetylene outfits in regular use. BHS (7b)

Industrial Safety. A. S. TROLLIP. *Indian & Eastern Engr.,* Vol. 80, Jan. 1937, pp. 72-73. Welding health hazards, created by injurious light rays and by fumes and gases produced by the action of heat upon the material welded, and the methods of protection against them are considered. APS (7b)

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8. FINISHING

H. S. RAWDON, SECTION EDITOR

Mechanical Surface Treatment of Aluminum and Its Alloys (Mechanische Oberflächenbehandlung von Aluminium und seinen Legierungen) A. v. ZEERLEDER & E. ZURBRÜGGE (Aluminium Ind. A.-G.) *Aluminium,* Vol. 19, June 1937, pp. 366-371. Original research. Systematic experiments were made to find the most suitable methods of producing desired surface qualities. Brushing, polishing, grinding and sandblasting are discussed and best working conditions described. Ha (8)

8a. Pickling

Heating of Cleaning Solutions. J. B. NEALEY. *Ind. Heating,* Vol. 4, June 1937, pp. 489-494. General review. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 280R/5. Ha (8a)

Pickling and Annealing of Brass. *Machinery, London,* Vol. 50, June 3, 1937, pp. 288-289. Practical, on bright annealing of brass tubes. Weak H_2SO_4 pickling solution forms no fumes but as there is no mechanical action to assist in the descaling, the process is very slow. 10% H_2SO_4 + 3% $K_2Cr_2O_7$ is much faster. Nitrosulphuric acid mixtures give a brighter surface but are apt to attack the metals excessively. JZB (8a)

8c. Polishing & Grinding

Finishing Cemented Carbides. H. R. POWER (Carborundum Co.) *Modern Mach. Shop,* Vol. 9, Apr. 1937, pp. 108-112. Practical. Surfaces that have been hardened to a very high Brinell number as W, Ta or Ti carbides can be finished by the use of Al_2O_3 wheels, with speeds of 4000-4500 ft./min.; the pressure of the piece against the wheel should be light to avoid excessive heating and wheel wear. Practical suggestions on equipment and procedure are given. Ha (8c)

8d. Electroplating

Anodizing of Aluminum Alloys in Chromic Acid Solutions of Different Concentrations. R. W. BUZZARD (Natl. Bur. Stds.) *Metal Ind., London,* Vol. 50, May 14, 1937, p. 555; *J. Research Natl. Bur. Standards,* Vol. 18, Mar. 1937, pp. 251-257. Original research. Investigation of the 3% CrO_3 anodizing bath showed that the recommended voltage cycle was essential for the formation of the best coating. Not only could the corrosion inhibiting properties of the coating be improved by increase in concentration of the electrolyte to 5-10% chromic acid, but the cycle could be eliminated, the time decreased, and the anodizing range of voltage and temperature broadened. 11 references. RWB + WAT (8d)

Deterioration of Chromic Acid Baths Used for Anodic Oxidation of Aluminum Alloys. R. W. BUZZARD & J. H. WILSON (Natl. Bur. Stds.) *Metal Ind., London,* Vol. 50, May 14, 1937, pp. 555-556; *J. Research Natl. Bur. Standards,* Vol. 18, Jan. 1937, pp. 53-57. Original research. Commercial practice has shown that CrO_3 baths for anodizing Al eventually fail. This failure, which had heretofore been attributed to other causes, is shown to be caused by dissolved Al. The addition of CrO_3 to the bath at regular intervals to maintain a constant pH is suggested as a means of improving bath control. RWB + WAT (8d)

Heavy Nickel and Chromium Deposition. CHARLES F. BONILLA. *Metal Ind., London,* Vol. 50, May 21, 1937, pp. 585-588. Description of the Fescol electrodeposition process as applied to recovery of worn machine parts. In the Ni bath boric acid is used to maintain the pH. Organic impurities are removed from the bath by a permanganate oxidation treatment. The maximum thickness of Ni so far deposited to build up worn parts was 7/16 in. diam., and required three wks. Every common metal (except Mg) has been successfully plated directly with Ni, no preliminary Cu deposit ever being used. Old Cr plate is removed anodically in a cold caustic solution. HCl is not used for stripping Cr. Rejects of Cr plated material are more frequent than those of Ni, the latter averaging 1%. Maximum Cr deposits are 0.1 in., which required several days. Cd, Cu, and Pb plating are touched briefly. RWB (8d)

Magnetic Methods for Measuring the Thickness of Nickel Coatings on Non-magnetic Base Metals. ABNER BRENNER (Natl. Bur. Standards) *J. Research Natl. Bur. Standards,* Vol. 18, May 1937, pp. 565-583; *Metal, Ind., London,* Vol. 51, July 16, 1937, pp. 69-72. Original research. The local thickness of an electroplated Ni coating on a nonmagnetic base metal may be measured by a small permanent magnet, the attractive force being determined with a simple spring balance. Attractive force between magnet and coating is proportional to thickness of coating. Instrument is calibrated with Ni coatings of known thickness which have been deposited under about the same conditions as coatings to be tested. Ni coatings deposited under different conditions have somewhat different magnetic properties, but become uniform by heating to 750° F. Specimens of unknown history should be annealed before testing. Measurements on coatings as-deposited are correct within ±15% and on annealed coatings within 10%. The effect on magnetic measurements of factors such as curvature of the surface, type of base metal, and superimposed Cr coatings, is discussed. Magnetic method is applicable to the testing of Ni-plated brass plumbing fixtures. 6 references. WAT + RWB (8d)

Organic Contaminations in Nickel Baths. Sources and Methods of Purification. A. W. HOTHERSALL & G. E. GARDAM (Res. Dept. Woolwich) *Metal Ind., London,* Vol. 50, May 28, 1937, pp. 609-612. Original research. Organic impurities in almost any form in Ni plating solutions damage the Ni deposit by causing it to be brittle or pitted. Some impurities can be removed by boiling but, in general, one of three other methods is used: (1) electro-deposition, (2) adsorption and (3) oxidation. Adsorption method was tested for the removal of gelatin and dextrin from the Ni solution using MnO_2, ferric hydroxide, charcoal, and kieselguhr. MnO_2 was the most effective, kieselguhr the least. The best oxidation method is by use of permanganate. RWB (8d)

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Rapid Electrodeposition of Iron from Ferrous Chloride Baths. CHARLES KASPER (Natl. Bur. Standards) *J. Research Natl. Bur. Standards*, Vol. 18, May 1937, pp. 535-541; *Metal Ind., London*, Vol. 51, July 2, 1937, pp. 19-21. Original research. Ductile Fe can be deposited from $FeCl_2$ solutions at current densities up to 30 amp./dm.^{2} (280 amp./ft.^{2}), which is several times the customary rate of Fe deposition. Temperature and acidity of the baths must be maintained within narrow limits.
WAT + RWB (8d)

Crystal Structure of Copper Deposits. ARTHUR PHILLIPS (Yale Univ.) and WALTER R. MEYERS (General Elec. Co.) *Metal Ind., London*, Vol. 50, May 7, 1937, pp. 539-541. Original research. Study of the orientive effects of the geometrical structure of the basis metal, the current density limits for the extension of the cathode structure, and the effect of co-deposition of Pb and Zn on the structure of the Cu deposits. The deposit with 1.0 g/1. Pb to a Cu cyanide solution was structurally weak nonuniform and utterly valueless as a protective coating. The initial deposit (0.0002 in.) of the coating contained 35% Pb, the percentage increasing with the thickness of the coating. The surface deposits from solutions containing 0.1 to 0.01 g./1. of Pb were commercially usable and were brighter and more compact than the deposits of Cu alone. The effect of Zn was much less pronounced, the films were more compact but similar to those of pure Cu.
RWB (8d)

Improvements in Silver Plating. B. EGEBERG. *Metal Cleaning Finishing*, Vol. 8, June 1936, pp. 327-332. Review of methods and improvements in Ag plating during the last 15-20 yrs. with a short introductory history of Ag plating. Difficulties encountered and means taken to overcome them are emphasized. GBH (8d)

Bright Zinc Plating Process Produces Brillian Deposits Directly from Bath. RALPH M. DREWS (Republic Steel Corp.). *Steel*, Vol. 100, June 21, 1937, pp. 66, 68-70. Industrial note describing plating of rivets, bolts, and nuts with Zn having a brilliance of polished Cr directly from bath without aid of a bright dip. Hard-rubber barrels of squirrel-cage construction, means for loading and unloading barrels, a unique basket rinse and centrifuge drying are used. Solution contains per gal. 4-6 oz. Zn, 10-12 oz. NaOH, 12-15 oz. NaCN, ¼ oz. H_2MoO_4, and 1/7 oz. organic addition agent. Mo is essential for production of bright deposit without use of bright dip. With the organic brightener, a much brighter deposit is produced than is possible with either agent alone. Anodes of high purity Zn alloyed with an inert metal are used, so that anode efficiency may be brought close to cathode efficiency. Temperature of bath is 70°-85° F., tank voltage is 10-12 volts, and current density is 10-15 amps./ft.^{2} MS (8d)

8e. Metallic Coatings other than Electroplating

The Methods of Testing Zinc Coatings. L. KENWORTHY (British Non-ferrous Metals Research Assoc.) *J. Inst. Metals*, Vol. 61, 1937, Advance Copy No. 771, 19 pp. Reviews critically various methods that have been used for determining weight, thickness, and uniformity of Zn coatings on Fe. The electrolytic stripping method is recommended for determination of coating weight. By using this method with time-voltage curves, weight of Zn layer and weight of alloy layer can be determined. The Preece test ($CuSo_4$ dip) may be misleading unless it is subjected to a correction factor for the type of coating being tested and in addition checked periodically by some method of actual weight determination. 54 references. JLG (8e)

Cementation of Some Metals by Tantalum. T. KASE. *Kinzoku-no-Kenkyu*, Vol. 14, Apr. 1937, pp. 130 to 137. In Japanese. Original research. With pulverized ferro-Ta (84.24% Ta, 0.11% C, bal. Fe) the cementation of Fe and Ni with Ta was investigated at various temperatures between 800° and 1300° for Fe, or 800° and 1100° for Ni, for 1 to 5 hrs. For the surface layer of the cemented specimens, the depth of penetration, microstructure, chemical composition and corrodibility by some acids were determined. Ta diffuses into the metals mentioned at a temperature lower than 800°, and the rate of diffusion increases with rise in temperature. The relation between the weight increase of the specimen (ΔW) or the depth of penetration (P) and the absolute temperature of cementation (T) or the time (Θ) required for the treatment is given by an exponential function (see foregoing abstract). Cemented surface of Fe is considerably harder than the original material, but that of Ni only slightly. Although the cemented surfaces with Ta resist dilute HCl or H_2SO_4, they have little advantage otherwise with respect to corrosion resistance.
KT (8e)

Reactions in Which an Exchange of Metal Atoms Takes Place Between a Gaseous and a Solid Phase (Über Reaktionen bei denen ein Austausch von Metallatomen zwischen einer Gasphase und einer Festen Phase stattfindet) GOTTFRIED BECKER, EDUARD HERTEL & CLEMENS KASTER (Bonn Univ.) *Z. physik. Chem.*, Vol. 177 (A) Sept. 1936, pp. 213-223. Original research. A current of H containing HCl reacts with metallic Cr at 950° C. with formation of $CrCl_2$ gas. When this gas comes in contact with Fe, a reaction takes place on the Fe surface during which Cr and Fe atoms are exchanged according to the formula: $Fe + CrCl_x = FeCl_x + Cr$, where $x = 2$ or 3. The Cr so deposited diffuses into the Fe specimen to form an Fe-Cr solid solution, to a depth of up to 1 mm. Metallographic and X-ray investigation of the "chromided" case showed that it had a uniform thickness and that the Cr diffusion was accompanied by a formation of new crystallites. The Cr content of the case decreases with increasing distance from the surface of the specimen. The outer zone of the case, practically a C-free Fe-Cr solid solution with Cr up to 40%, is ductile and is not attacked by nitric acid of all concentrations at any temperature. At a depth at which the Cr content of the case is about 15%, a thin intermediate zone of a Fe-Cr-C eutectic with 5% Cr and 5% C is present whose thickness is the greater, the greater is the thickness of the outer zone and the higher is the C content of the base metal. The "chromiding" process does not change the dimensions of the specimen and can be conducted at temperatures at which no recrystallization of the base metal occurs. Analogous experiments on "chromiding" Ni or Co specimens with the intervention of $CrCl_2$ were equally successful, but those on "cementation" of Ag with Au or of Cu with Ag failed. [An important contribution, as the described new method appears to possess great technical potentialities. O.R.S.] [U. S. Patent 2,046,638 covers a similar process, NaCl being used instead of HCl with no H_2. H.S.R.]
ORS (8e)

Cementation of Some Metals by Vanadium. T. KASE. *Kinzoku-no-Kenkyu*, Vol. 14, Apr. 1937, pp. 120-129. In Japanese. Original research. With pulverized ferro-vanadium (80.97% V, 0.02% C, bal. Fe) the cementation of Fe and Ni by V was investigated at various temperatures between 950° and 1300° C. for 1 to 5 hrs. For the surface layer of the cemented specimens, the depth of penetration, microstructure, chemical composition, as well as corrodibility by some acids, were determined. V diffuses into Fe and Ni at a temperature lower than 900° C. and the rate of diffusion increases as the temperature rises. The relation between the weight increase of the specimen (ΔW) or the depth of penetration (P) and the absolute temperature of cementation (T) or the time (Θ) required for the treatment is given by an exponential function $\Delta W = ae^{-b/T}$, or $\Delta W = ae^{b\Theta}$, where a and b are different constants in each case. The cemented surfaces become somewhat harder than the original material. Fe cemented with V resists concentrated nitric acid, owing to its passivity but other cemented metals show little advantage with regard to corrosion-resistance.
KT (8e)

8f. Non-Metallic Coatings

Rust Protection Investigations at the Government Station for Testing Materials (Rostskyddsundersökning vid Statens provningsanstalt) KURT LAURELL. *Tek. Tid.*, Vol. 67, July 10, 1937 (Section *Kemi*), pp. 51-56. Describes laboratory tests on samples of Fe painted with various types of Pb, Zn, ochre, and asphalt-tar paints containing 15% Al. The test pieces were successively exposed to moisture, CO_2, SO_2; salt water, temperature changes and ultraviolet light, over a period of 1 wk., about equal exposure to each condition. This "cycle" was then repeated for 12 wks. Some of the paints lasted only 4 to 11 wks., but the asphalt-tar Al paints stood up very well.
BHS (8f)

Light Metals and Alloys, Cast and Wrought, Report of A.S.T.M. Committee B-7. SAM TOUR, Chairman. *Am. Soc. Testing Materials.* Preprint for June 1937 meeting, 21 pp. Progress report. Appendix I on data obtained in the study of the modulus of elasticity of sand cast alloys is not included in the preprint. **Appendix II: Report on Methods of Testing Oxide Coatings on Aluminum.** JUNIUS D. EDWARDS, Chairman Subcommittee VI. Methods of testing oxide coatings on Al produced by making Al and its alloys anode in an electrolyte such as sulphuric acid, oxalic acid, chromic acid, or other electrolytes generally acid in nature are described and results given. Coating thickness is measured by the microscope and by stripping. Resistance to abrasion is measured by abrasive air blast, and rotating wheel abrasometer. For electrical usage, breakdown voltage is determined.
VVK (8f)

9. TESTING

Measuring Elastic Drift. ROBERT W. CARSON (Instrument Specialties Co.). *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 10 pp. Spring elements in precision instruments may be subject to appreciable errors as the result of elastic drift, or deviations in elastic deflections occurring with continued time under a constant load. A recording electronic micrometer, sensitive to deviations as small as a millionth of an inch, was developed to measure deflections of spring members without disturbing the load deflection. Typical records show that drift continues indefinitely at a decreasing rate as long as the load remains. Test procedure is described for drift measurements on flat strip specimens and actual elastic elements used in instruments. 26 references. VVK (9)

Measurement of the Electrical Resistance of Metals as a Function of the Temperature by Means of a Twin-galvanometer with Photographic Recording. E. ROSENBOHM & F. M. JAEGER (Univ. Groningen) *Proc. Koninkl. Akad. Wetenschappen Amsterdam,* Vol. 39, No. 3, 1936, pp. 374-383. In English. Original research. The apparatus employed is described in full detail. Experiments were made on Ni in a vacuum and in H_2 in the temperature range of 15-430°C. The results did not check. EF (9)

9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

Radiology in Testing. V. E. PULLIN. *Metal Ind., London,* Vol. 50, May 7, 1937, pp. 532-533. Up-to-date review. X-ray equipment is readily portable and has 3 main engineering applications: Examination of castings of new design, inspection method for metal structures, and crystal analysis. Radium has the advantages of portability, usability in places inaccessible to X-rays, greater penetration than X-rays. But, on the other hand, it requires longer exposures and gives poorer detail than do X-rays. RWB (9a)

Physical Methods in Metallurgy. BRUCE CHALMERS (Sir John Cass Tech. Inst.) *Metal Ind., London,* Vol. 50, May 28, 1937, pp. 597-600; June 11, 1937, pp. 645-648; Vol. 51, July 9, 1937, pp. 31-34. Up-to-date review of application of optical interference to precision measurements and use of interference fringes for examination of surface irregularities. Also discusses electron diffraction, X-ray, diffraction, electronic methods, etc. 31 references. RWB (9a)

Non-ferrous Metals and Alloys, Report of A.S.T.M. Committee B-2. R. F. MEHL, Chairman. *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 8 pp. Progress report. A new Proposed Tentative Specifications for Rolled Zinc (B 69) is presented to replace B 69-29 which does not conform to present trade practice. Apparatus and procedure of the dynamic ductility and the temper tests are described and the range of properties obtained given as a matter of information. VVK (9a)

9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

Improvement in the Adaptability of the Tuckerman Strain Gage. L. A. MEISSE (Ohio Brass Co.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 5 pp. Transfer mechanisms have been developed as described in this paper, for the purpose of improving the adaptability of the Tuckerman optical strain gage. These consist of a special construction of parallel flexure plates which transmit the movement from the specimens to the gage body. This permits precision measurements in inaccessible places which otherwise would have required the construction of special gages of very limited range of usefulness. Some commercial applications of the system are given, and a broader use of similar flexure plate transfers to other types of strain gages is shown. The broadening of the adaptability of strain gages to general displacement measurements widens their scope of usefulness in the testing laboratory. VVK (9b)

Relations between Stress and Reduction of Area for Tensile Tests of Metals. C. W. MACGREGOR (Mass. Inst. Tech.) *Metals Tech.,* Vol. 4, Apr. 1937, T.P. 805, 19 pp. Mathematical. Different methods of plotting stress-strain and stress-reduction in area curves are critically discussed. A new method was suggested in which the average true stress P/A is plotted as a function of the true reduction in area $q' = \log A_o/A$ where A_o is the original area and A the area at any load P. Tensile tests were made on various metals and such curves plotted. For all of the steels tested and for most of the nonferrous metals the curve became a straight line from the point corresponding to the maximum load up to fracture, as distinguished from the curve usually obtained for P/A plotted as a function of $q = (A_o - A)/A_o$. This fact permitted the formulation of a new law giving the relation between the average true stress and the true reduction of area within the necking region of the tensile test. It also provides a relation between the tensile strength and the breaking strength such that one may be calculated from the other. The anomalous behavior of the commercially pure Al and Cu was explained by means of X-ray results showing that cracks formed before the specimens broke. JLG (9b)

Methods of Testing, Report of A.S.T.M. Committee E-1. W. H. FULWEILER, Chairman. *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 14 pp. Progress report. **Appendix: Yield Strengths Corresponding to Small Percentages of Set.** G. F. JENKS. Studies were undertaken to determine whether the methods recommended for determining yield strength as given in the Standard Definitions of Terms Relating to Methods of Testing (E 6-36) should include some method of determining yield strength corresponding to a very small amount of offset (of the order of 0.003%) for which the existing methods may not be satisfactory. Yield strengths of S.A.E. steels No. 2340 and 4150, hard bronze, 18-8, stainless iron, Monel metal and Ni-steel forging were determined by various methods at the Watertown Arsenal on an Amsler testing machine using a Baldwin-Southwark autographic-recorder. It was concluded that very small values of offset are required only for heat-treated steels of high quality and possibly some other materials in which design requirements are severe and that an offset percentage of less than 0.005% is not justified except for experimental purposes. No need exists for changing E 6-36. VVK (9b)

The Stiffness or Flexure Test. H. L. MACBRIDE (Tinius Olsen Testing Machine Co.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 10 pp. This paper discusses the test known as the cantilever bend, stiffness, or flexure test for light wire, sheet, and strip of various materials. A description is given of a stiffness testing machine (the Tour-Marshall tester) and the method of testing explained. Charts are shown of typical tests on different materials and a brief interpretation given, with a comparison of stiffness test results with those given by other methods. VVK (9b)

Testing Oxide Coatings on Aluminum (Methods Recommended by A.S.T.M.) *Metal Ind., London,* Vol. 51, July 23, 1937, pp. 91-93. Practical. Two methods are described for measuring coating thickness, each showing fair agreement with the other. The more accurate is a direct measurement method using a metallographic microscope but the other is more rapid, making use of a strip in 7/8 N-H_2SO_4 plus 2 g./1 Sb trioxide. Two methods for measurement of abrasion resistance are: Using a carborundum-air blast impinging on the coating and using a rotating wheel abrasiometer. One method of determining dielectric strength is cited. 3 references. RWB (9b)

The Mechanical Properties of Some Metals and Alloys Broken at Ultra High Speeds. D. W. GINNS (Cambridge Univ.) *J. Inst. Metals,* Vol. 61, 1937, Advance Copy No. 773, 11 pp. Original research. Properties of C steels, Cu, brasses, and Al alloys were investigated when broken in tension at very high speeds. Average time taken to reach the yield point was 0.001 sec., and to fracture 0.005 sec. A pressure-resistance method was used for measuring stress, and a photo-electric cell method for strain, the 2 being combined to give a direct diagram on the cathode ray oscillograph. Compared with ordinary test values, the yield point is increased very considerably, over 100% for some materials. The tensile strength is increased, but by a much smaller amount. Elongation and reduction of area are little different from those shown by ordinary tests. Types of fracture are almost identical with those obtained by ordinary tests. JLG (9b)

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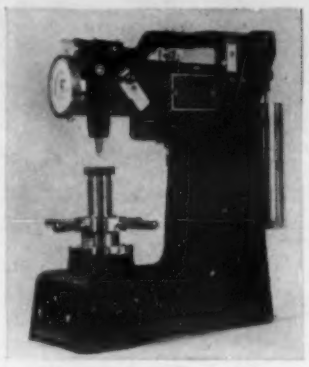

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The Effect of the Shape of the Test Piece upon the Energy Needed to Deform Materials in the Single Blow Drop Test. O. W. ELLIS (Ontario Res. Foundation) *Trans. Am. Soc. Metals,* Vol. 24, Dec. 1936, pp. 943-966. With discussion. Original research. An equation applying to cylinders, cones, conic frustra of equal volume, of steel, Ni at all temperatures and of Cu, Pb at room temperatures, and relating energy of blow in single-drop test and percentage reduction in height of sample is given. A study of etched sections indicates that the energy absorbed in the formation of the "ovoidal segment" becomes proportionally greater as the forging temperature is lowered and as the energy of the blow is increased. GEG (9b)

A Study of the Effect of Span on the Transverse Test Results for Cast Iron. J. T. MACKENZIE & C. K. DONOHO (American Cast Iron Pipe Co.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 10 pp. Original research. This paper investigates the variation in results of transverse tests of cast Fe caused by varying spans. Tests by previous investigators are discussed, as well as methods and results of new tests on rectangular bars of mono-cast and de Lavaud cast Fe. By mathematical analysis of results, quantitative measure of the effect of changing the span to depth ratio is developed for bars of both round and rectangular section. General conclusions were as follows: Modulus of rupture increases with decreasing span. Deflection decreases with decreasing span, but the decrease is much less than the conventional beam formula would indicate. Modulus of elasticity decreases with decreasing span. The rate of change of the values from de Lavaud strips with decreasing span is generally greater than that of the values from mono-cast strips. The amount of the effect of changing span depends largely upon the qualities of the Fe. VVK (9b)

Precision Extensometer Measurements on Tin. BRUCE CHALMERS (Sir John Cass Tech. Inst.) *J. Inst. Metals.,* Vol. 61, 1937, Advance Copy No. 775, 16 pp. Original research. A precision extensometer, reading by means of optical interference fringes to strains of 10^{-7} cm./cm., was used for creep experiments on Sn. Single crystals, specimens with but a few crystals with longitudinal crystal boundaries, and samples with small crystals were tested. Results show that the change of orientation across a crystal boundary affects the mechanical properties of the boundary and the relation between recovery and creep. Forms of the creep curves are discussed. JLG (9b)

Dynamic Tests by Means of Induced Vibrations. RUDOLF K. BERNHARD (Baldwin-Southwark Corp.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 12 pp. Review. Short report of a method of dynamic research in the engineering field. Various applications are discussed. Tests have been carried out since 1928, the system being used for various types of investigation, from small laboratory specimens to heavy ships. Different materials and all types of construction have been examined and compared by fatigue and aging tests. In the method described, vibration is induced by centrifugal forces resulting from revolving eccentric disks. As soon as the natural period of the structure coincides with the revolution of the disks, the amplitude of vibration of the system and the power imput to drive the revolving disks reaches a maximum. Plotting the power imput against the revolutions of the disks, characteristic curves can be obtained, which indicate first of all the natural frequency of the vibrating system which is to be investigated. Any coincidence between natural frequency and dynamic load, such as a locomotive with unbalanced masses passing over a bridge with critical speed, is to be avoided. Vibrating a structure with this type of oscillator for a long period has in many cases a similar effect as an annealing process; internal stresses remaining from the rolling process or due to welding are in some measure dissipated over the complete structure. A change in the natural frequency may indicate same failure or plastic flow; this forms a means to check from time to time the behavior of the structure, even after erection. 11 references. VVK (9b)

9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

The abstracts appearing under this heading are prepared in cooperation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

Some Aspects of the Fatigue Properties of Patented Steel Wires. III.—Note on the Effect of Low-temperature Heat Treatment on Decarburised Wires. E. T. GILL & R. GOODACRE. *Iron Steel Inst., London, Carnegie Schol. Mem.,* Vol. 25, 1936, pp. 93-110. Original research. Steels containing 0.37, 0.55, 0.79 and 0.86% C., decarburized to a depth of between 0.0005 and 0.0002 in., were studied. The fatigue properties of the decarburized wires after low-temperature heat treatment become very erratic, especially for the higher C contents, and are very different from those of the corresponding material free from decarburization. As the C content increases, the tempering temperature to obtain the best fatigue-resisting properties must be raised. The limiting fatigue stresses obtained for decarburized wire after tempering are very much lower than those found for the corresponding material drawn free from carburization, and the differences for the best recorded figures for each condition of surface are ± 6.9, ± 6.6, ± 10.2 and ± 17.9 tons/in.^{2} for the 0.37, 0.55, 0.79 and 0.86% carbon steels respectively. It is thought that the conditions of internal stress which exist between the inner structure and outer decarburized skin are responsible for the results mentioned above. 7 references. **Some Aspects of the Fatigue Properties of Patented Steel Wires. IV.—A Study of the Endurance Properties at High Stresses.** R. GOODACRE. *Ibid.,* pp. 111-139. Original research. The steels studied contained between 0.36 and 0.86% C. The drawing varied between 25 and 90% reduction, and tests were made from materials which were decarburized and from those free from decarburization. All wires tested were 0.080 in. diam., and the ranges of stress were so chosen that fracture occurred after about 20,000-100,000 repetitions of stress had been applied. Tensile and bend tests were also recorded. At very high stresses the decarburized wire proved superior, but, in ranges of stress likely to be met in service, wire free from decarburization proved the more satisfactory. For decarburized material the endurance properties show only a small variation over all the conditions observed, but the maximum properties appear to be developed in a tensile stress range of 100-110 tons./in.^{2} The endurance properties of wire drawn free from decarburization increase progressively as the tensile strength rises. The existence of critical amounts of cold-working is not confirmed, but evidence is given to suggest that the reverse bend test as usually carried out for wire is an endurance determination made at very high stress, and therefore should be used only for the comparison of similar wires. See *Metals and Alloys,* Vol. 7, Feb. 1936, p. MA 72R/4. CW (9c)

The Relation of Laboratory Research to Engine Design. HUBERT HAUTTMANN. *Trans. Northeast Coast Inst. Engrs. and Shipbuilders,* Vol. 52, pp. 103-126, discussion D77-D96, 1935-1936. WB (9c)

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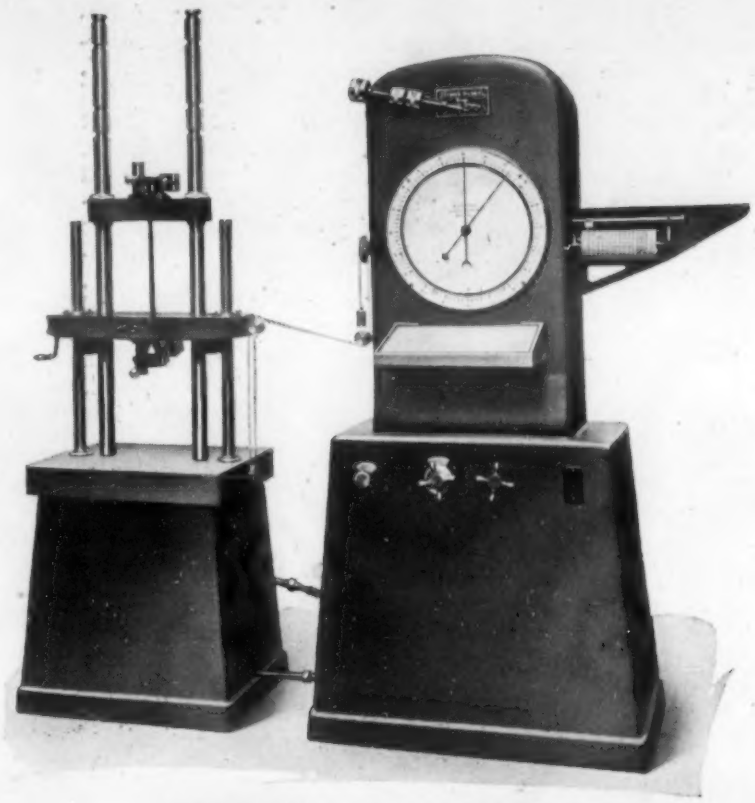

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Spinning and Explosion of Small Rotors. H. C. POLLOCK & C. H. COLLIE (Oxford Univ.) *Engineer*, Vol. 163, Jan. 22, 1937, pp. 102-103. Original research. Use is made of a modified Beams type of ultra-centrifuge for testing rotors up to 3 lb. weight. Compressed air is used for the motive power and the speed is measured by observing stroboscopically through holes in a rotating plate, a white dot painted with cellulose enamel on top of the drive wheel. Actual working conditions are obtained but very little damage is done except to the Pb lining of the vacuum chamber when the explosion occurs. Explosion tests were made on rotors made of a forged Al alloy (hiduminium R.R. 56), a Mg alloy (maguminium 166) and Cr-Mo steel. The Al alloy was tested in the forged and annealed condition, heat treated and ordinary quenched, heat treated and face-quenched, and heat treated and side quenched. The Mg alloy was tested only in the forged condition and in the forged and annealed condition while the Cr-Mo steel tested was hardened and tempered. The results of the tests are given and various equations are derived for the stresses occurring in a rotating body. It was concluded from the results that small rotors explode sooner than indicated by the formulas and the conclusions of other workers along this line were confirmed in supposing the interior of a rotating body to be in a plastic state when the stresses exceed the yield point of the material. It was found that this plastic state spreads outward until the whole disc is in this condition and the explosion takes place. Plastic flow and then rupture develops along the radial holes which affect the bursting speed. Tests were also conducted using tubes of Cr-Mo steel in 8 cm. lengths. The breaking speed was at 1200-1300 r.p.s. Vibration in the free ends may have caused this low breaking speed. LFM (9c)

On a Stress-strain Diagram of Repeated Load Test. S. HIGUCHI. *Nippon Kinzoku Gakukai-Si*, Vol. 1, May 1937, pp. 41-43. In Japanese. Original research. On a stress-strain diagram obtained by repeated load tests, the following conclusions were drawn: (1) Mechanical properties of test materials, such as yield point, tensile stress, etc., cannot directly be determined by load-deformation diagram or by outer moment-angle diagram as in the case of static test. (2) The stress at any point in the test piece for repeated loading can be determined from the following 3 factors: (a) a load or an outer moment including acceleration effects, (b) the frequency of load or the outer moment above mentioned, and (c) characteristic properties with respect to the natural vibration of the test piece. KT (9c)

Fatigue Properties of Non-ferrous Sheet Metals. C. H. GREENALL AND G. R. GOHN. *Preprint, Am. Soc. Testing Materials*, 1937. Original research. Report of a continuation of an investigation reported to Am. Soc. Testing Materials in 1929. Results are reported for brass, bronze, nickel-silver, beryllium-copper, copper-nickel silicide, everdur, nickel and aluminum alloys. Effect of grain direction on fatigue properties is shown for four of the alloys. Effect of surface treatment and electroplated finishes on fatigue properties of phosphor bronze is shown, as is the effect of grain size and surface treatment on nickel silver sheet. Dispersion hardening of alpha brass by addition of nickel silicide increases fatigue strength; so does cold work, but not proportionally to the increase in tensile strength. Age hardening markedly increases endurance of type K monel, aluminum alloy 17S and beryllium-copper. Ratio of endurance limit to tensile strength for alloys tested ranges from 0.136 to 0.403, the highest values being found for nickel and alloys of high nickel content. The machines used were multiple-specimen machines with flexural specimens. Each specimen served as its own dynamometer, and the tests were run at 750 cycles per minute. HFM (9c)

9d. Magnetic Testing

L. S. REID, SECTION EDITOR

Recovery of Magnet Steels (Sur les Cycles de Recul des Aciers à Aimant) HENRI LACOSTE-TAYAN. *Compt. Rend.*, Vol. 204, May 24, 1937, pp. 1556-1558, Vol. 205, July 12, 1937, pp. 122-124. General description is given of magnetic properties of 3 steels containing (1) 6% W, (2) 10% Co and (3) 35% Co. Shows the recovery as a function of the residual magnetism. FHC (9d)

9e. Spectrography

G. R. HARRISON, SECTION EDITOR

25 Determinations of Cast Iron in 25 Minutes. FRANK J. OLIVER. *Iron Age*, Vol. 139, May 20, 1937, pp. 25-29; ALFRED WALDCHEN (Michigan Univ.) *Michigan Technic*, Vol. 29, No. 5, Feb. 1937, pp. 6-7; *Foundry*, Vol. 65, May 1937, pp. 41, 130. Describes spectrographic analysis of alloy cast Fe on a commercial basis as employed by the Campbell, Wyant and Cannon Foundry Co., and equipment used. Gives elements present in 5 to 6 ladle mixtures. VSP (9e)

10. METALLOGRAPHY

J. S. MARSH, SECTION EDITOR

Nucleus Formation During Recrystallization V. Effect of Recovery on Speed of Nucleus formation and Subsequent Recrystallization (Ueber die Keimbildung bei der Rekristallisation. V. Einfluss der Erholung auf die Keimbildungsgeschwindigkeit bei nachfolgender Rekristallisation) M. KORNFELD & A. SCHAMARIN (Phys. Tech. Inst. Sverdlovsk) *Physik Z. Sowjetunion,* Vol. 11, No. 5, 1937, pp. 302-306. In German. Original research. It was previously shown that annealing of plastically deformed polycrystalline Al in the temperature range of pure relaxation lowers the velocity of nucleus formation during subsequent recrystallization (see *Metals and Alloys,* Vol. 7, July 1936, p. MA 362L/5). New tests were made on single crystals of 94.5% Al. The speed of nucleus formation was found to have increased when preannealing below the recrystallization temperature was applied. Interprets observed phenomena. See also *Metals and Alloys,* Vol. 8, June 1937, p. MA 350 R/4. EF (10)

Crystallization and Structure of Ingots. V. O. HAGEN-TORN. *Metallurg,* Vol. 12, Feb. 1937, pp. 3-19. In Russian. Largely a critical and comprehensive survey of the literature with a small amount of experimental work. Crystallization laws of Tammann can apply only to substances like silicates, that crystallize slowly. There are no possibilities for spontaneous crystallization; usually crystallization proceeds as a result of natural nucleation. Structure of ingots is determined by the amount and direction of heat transfer and possibility of formation of isolated crystals in any portion of ingots. Crystallization rate is determined by cooling speed and not by the amount of supercooling. 45 references. (10)

Formation of Nuclei During Phase Changes in Condensed Systems (Ueber die Bildung von Zentren der Phasenumwandlungen in kondensierten Systemen) E. ANDRONIKASCHWILI (State Univ. Tbilisi) *Acta Physicochim. URSS,* Vol. 6, No. 5, 1937, pp. 689-700. In German. Theoretical research. Relationships connecting the equilibrium crystallization nucleus with the undercooling of a melt are derived. These relations are analogous to the Thomson equation. At a definite undercooling, a nucleus may form without external supply of energy. The mechanism of the genesis of stable nuclei in undercooled liquids is critically discussed; the work W does not, as has been claimed by Gibbs & Volmer, represent a measure of the stability of supersaturated systems. The range of temperature and density variation necessary for the formation of equilibrium nuclei without energy supply are determined. EF (10)

Kinetics of Pearlite-austenite Transformation. I. L. MIRKIN & M. BLANTER. *Metallurg,* Vol. 12, Jan. 1937, pp. 65-69. In Russian. A steel containing (%) 0.98 C, 0.56 Mn, 0.39 Si, 1.16 Cr, was heated at 750-790° C. for different times and quenched in water. Uniformity of heating was obtained by using specimens 2 mm. thick. Heating at 760° C. for 90 min. produced no decomposition. At 770° C. complete transformation takes place in 1200 sec. When steel is heated to 790° C. transformation begins in 30 sec. and is complete in 210 sec. Decomposition process can be divided in 3 stages: (1) a slow stage, characterized by small contact surface between the pearlite and solid solution; (2) an increasingly rapid stage marked by growth of aggregates of solid solution; and (3) the last stage, which occurs at a decreased rate because the growing aggregates of solid solution unite, leading to a reduced surface of contact. Temperature rise rapidly increases. Rate of transformation increases with rising temperature. See *Metals and Alloys,* Vol. 8, Oct. 1937, p. MA 630L/3. (10)

High Speed Steel, Carbide Segregate and Grain Size. J. P. GILL (Vanadium Alloys Steel Co.) *Trans. Am. Soc. Metals,* Vol. 24, Dec. 1936, pp. 735-782. Original research. The carbide segregate and the grain size in an 18-4-1 high speed steel materially affect the rates of diffusion and hardenability, the strength and plasticity, and the hardness at elevated temperatures. X-ray data indicate that the primary constituent of the carbide segregate remains the same regardless of the structural condition of the steel. GEG (10)

Veining in Iron Alloys. B. VOLOVIK. *Metallurg,* Vol. 12, Feb. 1937, pp. 75-76. In Russian. A pronounced veining was observed in grains of high speed steel of the usual composition after heating for 6-8 hr. at 1200° C. in a closed silica tube and rapid cooling. (10)

Laws of Decomposition of Austenite into Pearlite. S. KAZEEV & M. REZNIK. *Metallurg,* Vol. 12, Feb. 1937, pp. 43-50. In Russian. Original research. Formula $A = 100e^{-at^n}$ which expresses the amount of undecomposed austenite A as a function of time t (a and n are constants) was checked. Small cylindrical specimens properly prepared for temperature recording were placed in a furnace heated to 925° C. and cooled in a magnetometer. The galvanometer readings of the latter were then converted to the amounts of austenite still present. Steels with 0.96-1.21% C and 0.32-6.68% Cr were investigated. If the above equation be expressed as $ln(2 - lnA) = n lnt + ln(alne)$ the equation of a straight line is obtained when time and $(2lnA)$ are plotted on log-log paper. Experimental data fall on this line quite satisfactorily, and the difference between the calculated and experimental values averaged 0.6%, indicating that the transformation of austenite into pearlite proceeds according to the above equation. Dynamics of the transformation are demonstrated by plotting the cooling curve against the decomposition curve and presenting numerical data obtained experimentally. The break in the cooling curves corresponding to critical points is shown to be a function of the difference between the received and expended heat rather than of the critical transformation itself. Greater heating of steel results in slower transformation rate, which drops in the interval 850-925° C. from 13.7 to 1.12% per sec. Cr greatly increases transformation speed when quenching is done from lower temperatures, carbides precipitate before the transformation range is reached. Transformation of steel takes place within a rather extended range of temperature, so that the conception of the A_{r1} *point* should correspond to the temperature at which the maximum speed of austenite-pearlite transformation is reached. (10)

The Theory of Phase Transitions II (Zur Theorie der Phasenumwandlungen II) L. LANDAU (Phys. Tech. Inst. Charkow) *Physik. Z. Sowjetunion,* Vol. 11, No. 5, 1937, pp. 345-355. In German. Theoretical research. There are no crystals whose density functions depend on only one or two coordinates. Studying the problem of the transition from liquid to crystal, it is proved that there can be no Curie points between those phases falling on a curve in the p-T diagram. The nature of liquid crystals is investigated. See also *Metals and Alloys,* Vol. 8, July 1937, p. MA 433L/2. EF (10)

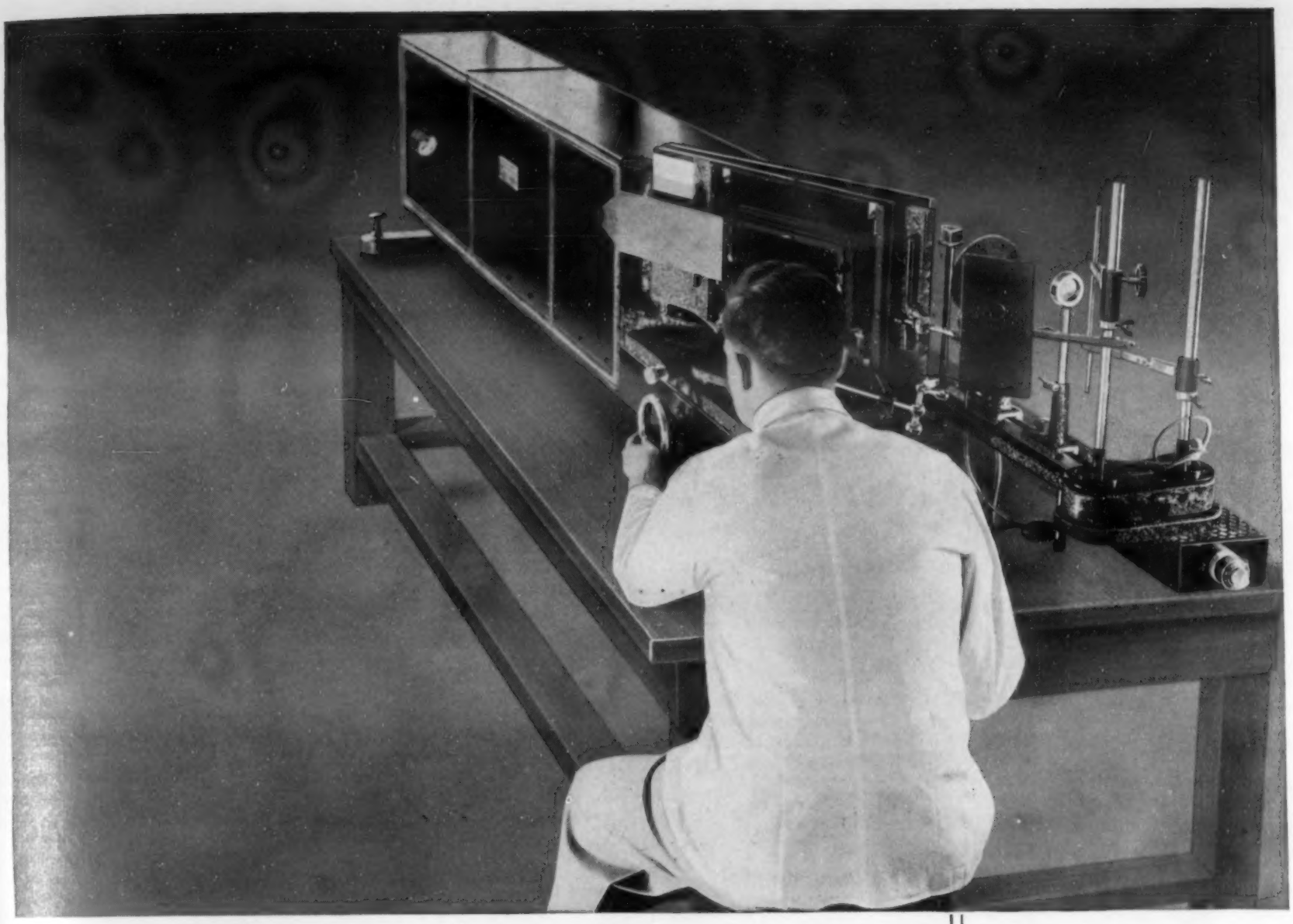
The Crystal Parameters of Osmium and Ruthenium at Different Temperatures. E. A. OWEN & E. W. ROBERTS (Univ. College North Wales) *Z. Krist.,* Vol. 96, June 1937, pp. 497-498. In English. Original research. The parameters of the hexagonal lattices of Os (99.8% pure) and Ru (chemically pure) were determined in the temperature range of 20-600° C., and the mean coefficients of thermal expansion (50-550° C.) are given. EF (10)

A Note on Absorption and Weissenberg Photographs. A. F. WELLS (Univ. Cambridge). *Z. Krist.,* Vol. 96, June 1937, pp. 451-453. In English. Discusses absorption when using a thin plate instead of the best suited cylindrical specimen. EF (10)

The Crystal Structures of Marcasite, Arsenopyrite and Loellingite. MAURICE L. HUGGINS (Kodak Research Lab.). *Z. Krist.,* Vol. 96, May 1937, pp. 384-385. Polemics against recent conclusions of BUERGER, *Z. Krist.,* Vol. 82, 1932, p. 165; Vol. 95, 1936, p. 83; *J. Am. Mineralogist,* Vol. 16, 1931, p. 361; Vol. 19, 1934, p. 37. EF (10)

Cementation of Nickel by Beryllium (Cémentation du Nickel par le Glucinium) JOSEPH LAISSUS. *Compt. Rend.,* Vol. 204, June 7, 1937, pp. 1732-1734. Original research. Description of alloy zones obtained upon diffusion of Be into Ni which confirms the phase diagram of Masing and Dahl. FHC (10)

Metallography, Report of A.S.T.M. Committee E-4. JOHN T. NORTON, Chairman. *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 3 pp. Progress report. A separate standing committee of the Society is to be organized to consider the subject of radiography and the study of X-ray diffraction methods will be continued. A Special Subcommittee on Grain Characteristics of Steel (M. A. Grossmann, Chairman) has been reorganized and is preparing a proposed grain-size standard which meets some of the objections of the present chart (E 19-33). VVK (10)



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The Decomposition of Gold-nickel Single Crystals (Der Zerfall von Gold-Nickel-Einkristallen) W. KÖSTER & A. SCHNEIDER (Kaiser-Wilhelm Inst. Metallforschung) *Z. Metallkunde,* Vol. 29, Mar. 1937, pp. 103-104. Experimental. Alloys of Au with 40% Ni were annealed at 400° C. and the decomposition followed by means of X-rays. The single crystals prepared by recrystallization act like polycrystalline material, the lattice constant of the matrix changing a measurable, but very small, amount during the precipitation. GD (10)

"Extra" Spots in Electron Diffraction Patterns. V. A. KOLPINSKY (Univ. Leningrad) *Physik. Z. Sowjetunion,* Vol. 10, No. 4, 1936, pp. 563-564. In English. Brief note offers explanation for the appearance of spots with "irrational" indices as found by Brueck (*Nature,* Vol. 137, 1936, p. 1078) in films for Ag, Ni, and Au. EF (10)

Experiments on Electrolytic Separation of Isotopes of Lithium (Versuche zur elektrolytischen Trennung der Isotopen des Lithiums) A. EUCKEN & K. BRATZLER. *Z. Physik. Chem.,* Vol. 174 (A) October 1935, pp. 269-272. Original research. Upon electrolytic precipitation of Li from a $LiSO_4$ solution onto a stream of Hg, repeated 4 times, the at. wt. of the precipitated Li^6 isotope increased negligibly. Thus the proportion of the Li isotopes (Li^7 and Li^6) had undergone but a very small change from which the upper limit of the partition factor is computed to be about 1.07. ORS (10)

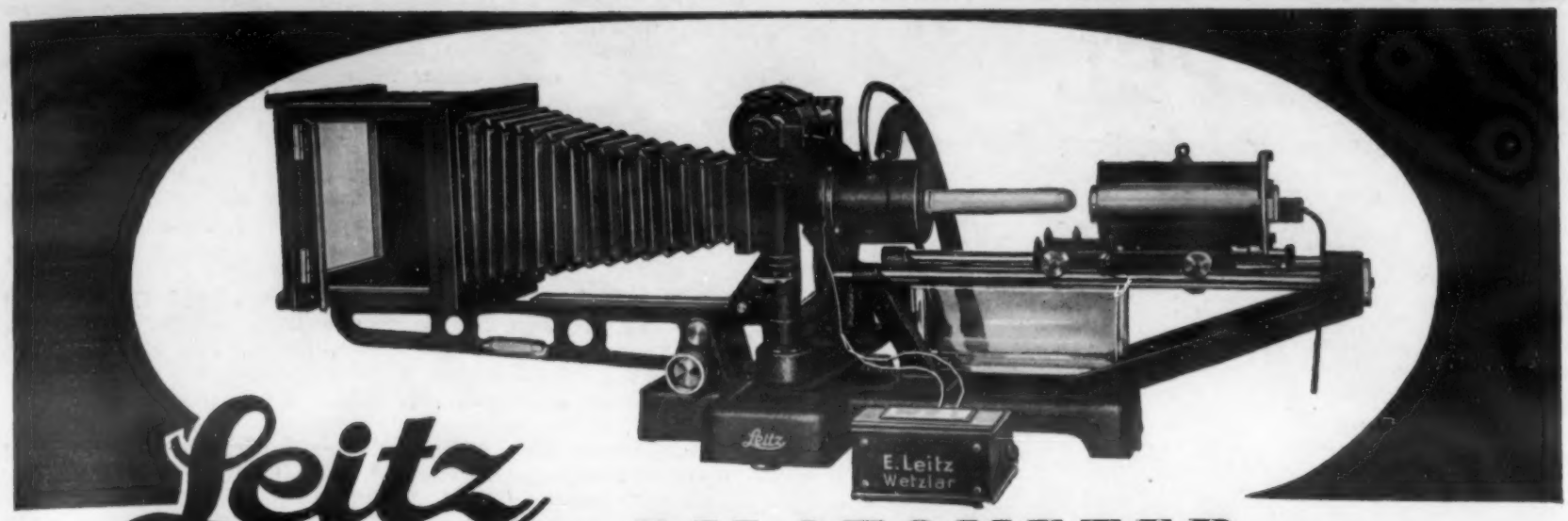
The Aging of Gold-nickel Alloys (Ueber die Aushärtung der Gold-Nickel-Legierungen) W. GERLACH (Univ. München) *Z. Metallkunde,* Vol. 29, Mar. 1937, pp. 102-103. Experimental. Magnetization, remanence, and coercive force curves were determined for Au-50% Ni alloys after aging for 0, 30, 150, 240 and 340 min. at temperatures increasing from 0 to 350° C. At high temperature the solid solution decomposes into a magnetically hard Au-poor phase and a non-magnetic Au-rich phase. This type of aging is microscopically heterogeneous. Simultaneously, but to a lesser extent, a homogeneous aging occurs, which lowers the Curie point in proportion to the decreasing supersaturation of the matrix. At high temperatures only 1 ferromagnetic phase is present, but at low temperatures 2 exist. It is concluded that the ratio of homogeneous to heterogeneous hardening is determined by the aging temperature and the amount of supersaturation. GD (10)

A Universal X-ray Photogoniometer. ROBERT B. HULL & VICTOR HICKS (Univ. Pittsburgh) *Z. Krist.,* Vol. 96, Apr. 1937, pp. 311-321. In English. Descriptive. A compact apparatus for making Laue, rotation, and Schiebold-Sauter photograms, without the intermediate transfer of the crystal, has been constructed, with which back reflection photograms may also be made. An accurate horizontal scale and verniers, combined with a microscope (which may be used as an autocollimating telescope) facilitates the adjustment of the crystal and permits interfacial angle measurements. All essential parts are adjustable with respect to the goniometer axis. The adjustment and the use of the apparatus are briefly described. EF (10)

Heats of Formation of Intermetallic Compounds (Ueber die Bildungswärmen intermetallischer Verbindungen) W. BILTZ (Tech. Hochschule, Hannover) *Z. Metallkunde,* Vol. 29, Mar. 1937, pp. 73-79. Review and discussion. Heats of formation of intermetallic compounds, as determined calorimetrically and by electromotive force measurements, are collected in 7 tables. The data are evaluated and the variation of heats of formation with composition, structure, and formula are discussed. GD (10)

Directional Properties in Rolled Brass Strip. MAURICE COOK. *Engineering,* Vol. 143, Mar. 26, 1937, pp. 337-338; *Sheet Metal Ind.,* Vol. 11, Apr. 1937, pp. 354-358. Includes discussion. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 169L/2. LFM + AWM (10)

The Crystal and the Engineer. SIR WILLIAM HENRY BRAGG. *J. Inst. Civil Engrs.,* No. 7, June, 1937, pp. 181-202. *Iron & Coal Trades Rev.,* Vol. 134, May 7, 1937, p. 843. *Electrical Rev.,* Vol. 120, Apr. 30, 1937, p. 658; *Engineer,* Vol. 163, May 7, 1937, pp. 530-532; May 14, 1937, pp. 560-561; *Engineering,* Vol. 143, Apr. 30, 1937, pp. 499-500. Up-to-date review. A discussion on the subject of crystalline structure of materials used by the engineer deals with the extent to which X-ray powder photographs have given information on the phases of binary and ternary alloys. "Structure-sensitive" properties of metals such as plasticity, toughness, and hardness give rise to problems which X-ray methods have helped to solve, as in the case of recent investigations on fatigue. The study of surface condition has been reinforced by recent methods of electron-diffraction as in the investigation of the crystal growth and orientation of Al foil on heating. JWD + Ha + MS + LFM (10)



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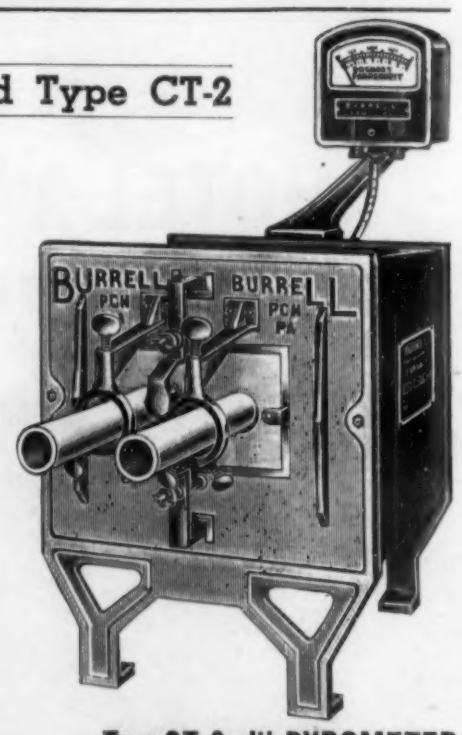

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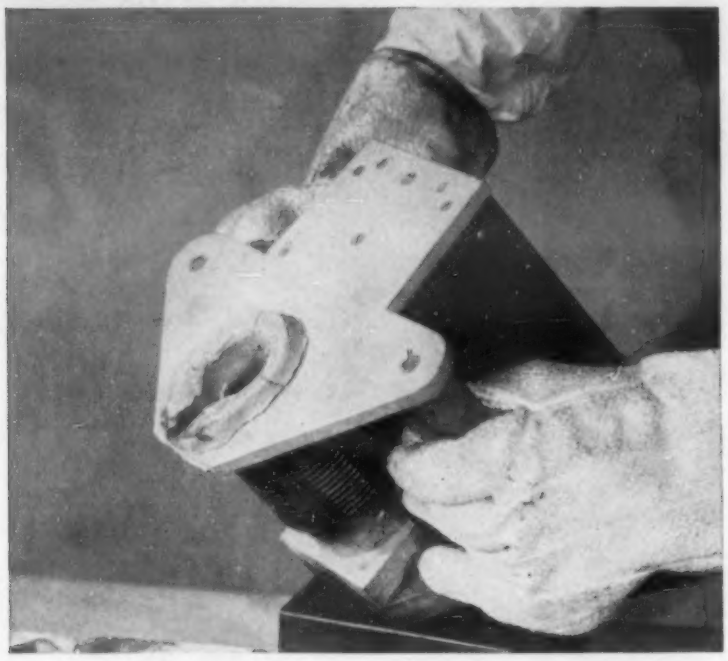

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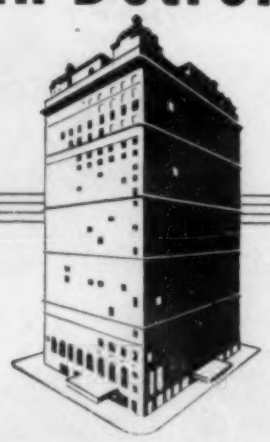

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The Theory of Transformations of Metallic Mixed Phases. IV. The Precipitation of Unordered mixed Phases (Zur Theorie der Umwandungen von metallischen Mischphasen. IV. Die Ausscheidung ungeordneter Mischphasen) G. BORELIUS. *Ann. Physik.*, Vol. 28, Mar. 1937, pp. 507-519. Theoretical discussion. Thermodynamically possible obstacles to the disintegration of mixed phases and the relation between the energy content of mixed phases in binary systems and gaps in the phase diagrams are discussed. The Cu-Ag system is used for illustration. 13 references. See also *Metals and Alloys*, Vol. 5, Nov. 1934, p. MA 533L/6. HA (10)

X-ray Study of the Structure of Copper, Lead, Cadmium and Antimony at High Temperatures. JOHN E. DORN & GEORGE GLOCKLER (Univ. Minn.) *J. Phys. Chem.*, Vol. 41, Mar. 1937. pp. 499-505. Confirmation of the well-known fact that macroscale properties are often unreliable guides to polymorphs. EF (10)

A Common Orientation and Classification for Crystals Based upon a Marcasite-like Packing. M. J. BUERGER (Mass. Inst. Tech.) *Am. Mineral.*, Vol. 22, Jan. 1937, pp. 48-56. Theoretical research. Organizes the many data available on the marcasite-like arrangement of atoms (a) by adopting a common orientation for these crystals based upon their structural similarity and (b) by providing a classification of these crystals based upon their structural differences. See also *Metals and Alloys*, Vol. 8, May 1937 p. MA 295L/10. EF (10)

The Behavior of Sulphides in the Slag-contact Method (Ueber das Verhalten von Sulfiden beim Schackenabdruckverfahren) R. MITSCHE. *Berg- u. Hüttenmänn. Fabrb.*, Vol. 85, Mar. 30, 1937, pp. 22-24. Original research. In determining the non-metallic inclusions in steel by the contact process of Niessner, the effect of FeS and MnS was investigated. It was found that both behave as do oxide inclusions but the specimens must be left longer in air. In order to obtain clear prints an AgBr paper impregnated with HCl should be used and K ferrocyanide used as developer. 8 references. Ha (10)

"Grain Size" in the Foundry (Le "Grain Size" en fonderie) M. GEVERS. *Fonderie Belge*, Vol. 4, July-Aug. 1936, pp. 446-449. Review. The McQuaid-Ehn test is explained and its application illustrated. FR (10)

Alloys of Magnesium. Part V.—The Constitution of the Magnesium-rich Alloys of Magnesium and Cerium. J. L. HAUGHTON & T. H. SCHOFIELD. *Engineering*, Vol. 143, Apr. 2, 1937, p. 368. Includes discussion. See *Metals and Alloys*, Vol. 8, Mar. 1937, p. MA166L/4. LFM (10)

A Study in the Metallography and Mechanical Properties of Lead. BRINLEY JONES. *Engineer*, Vol. 163, Mar. 26, 1937, pp. 356-357. *Engineering*, Vol. 143, Apr. 2, 1937, pp. 366-367. Includes discussion. See *Metals and Alloys*, Vol. 8, July 1937, p. MA 434L/6. LFM (10)

The Control of Composition in the Application of the Debye-Scherrer Method of X-ray Crystal Analysis to the Study of Alloys. W. HUME-ROTHERY & PETER W. REYNOLDS. *Engineer*, Vol. 163, Mar. 26, 1937, p. 357. *Engineering*, Vol. 143, Apr. 2, 1937, pp. 367-368. Includes discussion. See *Metals and Alloys*, Vol. 8, Mar. 1937, p. MA 162R/8. LFM (10)

The Solubility of Silver and Gold in Solid Magnesium. W. HUME-ROTHERY & EWART BUTCHERS. *Engineering*, Vol. 143, Apr. 2, 1937, p. 368. Includes discussion. See *Metals and Alloys*, Vol. 8, May 1937, p. MA 294R/7. LFM (10)

The Estimation of Grain-size in the Region Above 10^{-5} cm. R. A. STEPHEN & R. J. BARNES. *Engineering*, Vol. 143, Apr. 2, 1937, p. 368. Includes discussion. See *Metals and Alloys*, Vol. 8, Feb. 1937, p. MA 99L/8. LFM (10)

The Constitution of Silver-rich Antimony-silver Alloys. P. W. REYNOLDS & W. HUME-ROTHERY. *Engineering*, Vol. 143, Apr. 2, 1937, pp. 368-369. Includes discussion. See *Metals and Alloys*, Vol. 8, July 1937, p. MA 434R/8. LFM (10)

Alloys of Magnesium. Part IV—The Constitution of the Magnesium-rich Alloys of Magnesium and Silver. R. J. M. PAYNE & J. L. HAUGHTON. *Engineering*, Vol. 143, Apr. 2, 1937, p. 368. Includes discussion. See *Metals and Alloys*, Vol. 8, May 1937, p. MA 294R/3. LFM (10)

The Liquid State. KARL F. HERZFELD (Catholic Univ.) *J. Applied Phys.*, Vol. 8, May 1937, pp. 319-327. Comprehensive review of theoretical studies on the liquid state. 42 references. HFK (10)

11. PROPERTIES OF METALS AND ALLOYS

A Proposed Standard Classification of Graphite in Gray Cast Iron. W. E. MAHIN (Westinghouse Elec. & Mfg. Co.) & J. W. HAMILTON (Vanadium Corp. Am.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 8 pp.; *Iron Age,* Vol. 140, Aug. 19, 1937, pp. 35-38. The need has been pointed out for a metallographic system of classification of the graphite phase in gray cast Fe. Two proposed standard charts have been set forth. One of these in serving to identify graphite flake size is similar to the A.S.T.M. grain size chart for steels. The other represents 4 types of association of graphite flakes differing from each other in their distribution or orientation. A technique for the application of these two charts has been proposed with emphasis laid on the use of suitable magnifications in order to produce a record representative of the entire area of the microsection. VVK + VSP (11)

Elastic Properties and Their Relationship to Strength and to Strain Hardening. M. F. SAYRE (Union College) *Trans. Am. Soc. Metals,* Vol. 24, Dec. 1936, pp. 932-942. Review. Variations in the effective modulus of elasticity in adjacent grains imply corresponding stress variations. Cold work tends to give directional increase of strength. Stiffness variations in adjacent grains may cause surface imperfections in cold pressing operations, and may explain deviations between theoretical and experimental results in cases of localized stress concentrations. GEG (11)

Temperature Changes Accompanying Elongation of Metal Rods (Die Temperaturänderungen beim Recken von Metallstäben) G. TAMMANN & H. WARRENTRUP. *Z. Metallkunde,* Vol. 29, Mar. 1937, pp. 84-88. Discussion and original research. Within the elastic range metals cool during elongation, while in the plastic range they heat appreciably. An effort was made to determine the boundary between the elastic and plastic regions by this method. However, the curve for the plastic temperature changes is exponential and follows the linear temperature decrease curve so closely in its early stages that a sharp distinction cannot be drawn with annealed metals. With preworked metals a sharp break occurs when the maximum stress previously attained is passed. GD (11)

Makes **Progress in Reduction of the Wear of Metals.** *Foundry,* Vol. 65, Apr. 1937, pp. 134, 139. Abstract of recent symposium of Am. Soc. Testing Materials. H. W. Gillett discussed the general aspects of the problem, while D. E. Ackerman's paper covered important variables in wear tests on cast Fe. Other topics discussed were: Wear in textile industry, by Albert Palmer; Wear of power equipment, by N. L. Mochel; Tests conducted on railroad materials, by L. W. Wallace; and Tests of automobile materials, by W. E. Jominy. VSP (11)

Recent Work on the Physical Properties of Thin Metal Films (Neuere Arbeiten über die physikalischen Eigenschaften dünner Metallfilme) HERBERT LANGE (Tech. Hochschule, Dresden) *Kolloid-Z.,* Vol. 78, Jan. 1937, pp. 109-114; Feb. 1937, pp. 231-240. Unusually comprehensive correlated abstract, classifying and discussing briefly in each case literature under the following headings: Preparation of films, general considerations, structure of the films, thermal investigations, electrical properties, magnetic properties, optical properties, photo-electric properties, thermionic emission. 276 references. FPP (11)

Mass-spectrograph Analysis of Beryllium. WALKER BLEAKNEY, JOHN P. BLEWETT, RUBBY SHERR & ROMAN SMOLUCHOWSKI. *Phys. Rev.,* Vol. 50, Sept. 15, 1936, pp. 545-546. Original research. A new source of ions suitable for positive ray analysis was developed in the form of a molecular beam from a hot oven. Ions were produced in the beam by electron impact and focused on the entrance slit of the mass spectrograph by suitable electric fields. The method was applied to the study of Be but only Be^9 was found. The experiment placed an upper limit on the existence of Be^8 of one part in ten thousand. WAT (11)

Change of Heat Conductivity of Metals in the Transverse Magnetic Field (Äenderung der Wärmeleitung von Metallen im Transversalen Magnetfeld) M. KOHLER. *Ann. Physik.,* Vol. 29, June 1937, pp. 256-263. Theoretical research and discussion of thermal conductivity and the electron theory. Conductivity is reduced, at low field intensities, H, proportional to H^2 and inversely proportional to T^2 (temperature); for high values of H a limit of thermal conductivity was found. The Wiedemann-Franz law is valid throughout. Ha (11)

Apparatus for Measuring the Heat Conductivity of Metal Sheets (Eine Apparatur zur Messung der Wärmeleitfähigkeit von Metallblechen) A. EUCKEN & HILDEGARD WARRENTRUP. *Z. tech. Physik,* Vol. 16, Apr. 1935, pp. 99-105. Detailed description of a new apparatus for measuring thermal and electrical conductivity of metals and of the method of evaluation of the measured data. The use of sheet specimens permits convenient preliminary mechanical and thermal treatment of the metal. By permanent built-in heating device, thermoelements, electrical contacts, and by the use of standard-size disc-shaped specimens the time required for one measurement is reduced to a minimum, the accuracy being ±1%. The following results are given:

	Thermal conductivity cal./cm. °C.	Electric conductivity 10^{-4}/ohm cm.
Technically pure Al with about 99.7% Al	0.534	37.10
Al with 99.66% Al, 0.20% Fe, 0.14% Si	0.540	37.20
Purest electrolytic Cu from Heraeus....	0.935	62.8

ORS (11)

The Flow of Metals. E. N. DA C. ANDRADE. *Iron & Coal Trades Rev.,* Vol. 134, May 7, 1937, p. 843; *Metal Ind., London,* Vol. 50, May 7, 1937, p. 533; *Engineer,* Vol. 163, May 7, 1937, pp. 544-545; *Engineering,* Vol. 143, May 14, 1937, pp. 556-557. Theoretical. The actual behavior of molecules in the liquid state is not yet so well understood as flow in gases or the structure in crystalline solids, which can be observed by X-ray methods. The mechanism of flow in molten materials and in solids is discussed and the author's theory of liquid viscosity explained, from which can be derived a formula for the viscosity of a simple liquid at its m.p. and another formula for the temperature variation of the viscosity. Ha + RWB + LFM (11)

The Longitudinal Change of Resistance in a Magnetic Field According to the Elementary Theory (Ueber die longitudinale Widerstandsänderung im Magnetfelde nach der elementaren Theorie) A. SOMMERFELD & B. W. BARTLETT. *Z. tech. Physik,* Vol. 16, Nov. 1935, p. 500. Theoretical. Calculations of the longitudinal change of resistance of metals in a magnetic field based (1) on the slightly modified "elementary" theory of Sommerfeld and (2) on the wave-mechanical theory of metal electrons (see: S. TITEICA. *Annalen der Physik,* Vol. 22, 1935, pp. 129-161) lead to very similar results. In both cases the calculated values fall far short of those observed. ORS (11)

Surface Phenomena and Properties of Alloys. V. K. SEMENCHENKO. *Tsvetnye Metal.,* No. 6, July 1936, pp. 92-100. Review plus original research. Metallic solutes, similarly to non-metallic solutes, may be divided into 2 classes: (1) surface active—those that lower the surface tension of solvent metal crystallites, and (2) inactive, which raise it. It is noted that the first small additions exert greatest influence on the surface tension of the solvent metal, further additions producing weaker effect. Reference is made to previous work (*Z. f. Phys. Chemie,* v. 129, p. 176, 1927; *Koll. Zeit.,* v. 60, p. 170, 1932; *Jour. Phys. Chem.* (Russian), v. 3, p. 285, 1932; *Achievements of Chemistry* (Russ.), v. 3, p. 710, 1934), in which was developed a molecular theory of surface tension. Experiments showed that the "totalized moment" of metal ions (ionic charge multiplied by valence and divided by ionic radius) determines certain properties of metals including surface tension and surface activity, compressibility and thermal expansion. The theoretical discussion of the subject is substantiated by experimental data on Co, Zn, Cd, Ag, Hg, Sr, Pb, Sn, Ba, Li, Na, K, Rb and Cs, which show that metal solutes whose ionic moment is less than that of the solvent metal will lower the surface tension of the solvent, and, conversely, solutes whose moments are greater, will raise the surface tension of the solvent. On the basis of this theory the action of modifiers is a result of lowering of the surface tension of solvents by the metals used in modification: Na, K, Rb, Ba, etc. Concentration of a modifier metal at the phase boundaries lowers the velocity of crystallization. As the crystallites grow, their surface layers become richer in surface active modifier until a continuous layer of the modifier metal, at least one molecule thick, is formed on the surface of the crystallites, and the growth of crystals ceases. Lowering of surface tension also results in better fluidity in casting. By selecting solutes of known moments the surface tension of phase boundaries can be controlled, and, therefore, the solubility increased (liquation prevented) or decreased. Surface-active metallic solutes are also interesting from the point of view of their effect on catalytic and photo- and thermochemical properties of alloys. 10 references. BND (11)

Flow Phenomena in Heavily Stressed Metals. P. W. BRIDGMAN (Harvard Univ.) *J. Applied Phys.*, Vol. 8, May 1937, pp. 328-336. Supplements and interprets recent original research on behavior of substances in combined shear and hydrostatic pressure. (For experimental details see *Phys. Rev.*, Vol. 48, 1935, pp. 825-847.) An atomistic interpretation of the shearing process is attempted. In an ideal lattice the net work of a shear displacement through a distance of one a_0 is zero but in actual cases continued force is required. This Bridgman considers to be due to "atomic roughness" which in a steady state of slip are being created at the same rate they are being destroyed by being pushed irreversibly aside on the first half step. The new ones appear at random on both half steps, the net result being continuous resistance to slip. This resistance should be independent of speed of slip but if the irreversible pushing aside of "roughnesses" is followed by a recovery proceeding at about the same rate as the slip then the force may depend on the slip speed. A small effect of this kind is observed in metals such as Sn and Pb which have low recrystallization temperatures, the force changing ten fold for a speed change of ten thousand fold. The recovery of the irreversibly pushed aside "roughness" allows the return on the second half step of some of the irreversibly lost energy and reduces the slip force. Since the average atomic force determining shear is a different sort from that determining compressibility it is hard to form any quantitative ideas of effects to be expected. Actually the shearing strength is increased by a large factor by increasing the hydrostatic pressure to around 50,000 kg./cm.^{2} Sometimes transient effects such as shear by sudden snapping are had but 43 of the metals studied sheared smoothly. In conclusion the author emphasizes the need of taking into consideration shearing phenomena in theoretical attempts to compute the cohesive strength of solids. HFK (11)

The Effect of the Loading Velocity in Tensile Tests (Einige Bemerkungen zum Einfluss der Belastungsgeschwindigkeit bei Zerreissversuchen) W. SPÄT. *Aluminium*, Vol. 19, May 1937, pp. 312-315. Review. The usual assumption of the interior friction resistance does not suffice to explain the plastic processes in loaded materials, and a better agreement with the practical behavior of the materials is obtained if the total deformation under a given load is taken as the geometrical sum of 2 individual deformations. 5 references. Ha (11)

The Effect of Silicon on the Mechanical Properties of Acid Electric Steel. SHUZABURO YABUUCHI (Osaka Army Arsenal) *Tetsu-to-Hagane*, Vol. 23, May 25, 1937, pp. 413-419. In Japanese. Original research. (1) With the increase of Si content in acid electric steel, elastic limit and tensile strength increase, but reduction of area, elongation, impact strength, and resistance to hammering decrease. (2) The above result is more noticeable in dynamic than in static tests. (3) With the increase of Si content, the breaking up of primary crystals becomes difficult, which hampers grain-refinement in forging. (4) The results of (1) and (2) can be observed distinctly in annealed steels. (5) Steels containing a comparatively large quantity of Si may regain their toughness by increasing forging ratio and then by heat-treating. (6) Heat treating the steels remarkably improves fatigue test results. NS (11)

11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

The Effect of Manganese on the "Annealing Brittleness" of Cupro-nickel. B. K. BOSE (The Mint, Bombay) *J. Inst. Metals*, Vol. 60, 1937. Advance Copy No. 768, 9 pp. Original research. Describes investigation of effect of Mn on brittleness of 75:25 Cu-Ni alloy that sometimes results from annealing at temperatures above 700° C. Previous observations had shown that this brittleness, in the absence of Mn, is caused by precipitation of graphite at grain boundaries. About 1% Mn cures brittleness in alloys containing about 0.1% C. Mn up to 1% has little influence on amount of C absorbed or on amount of graphite precipitated by annealing. JLG (11a)

The Mechanical Properties of Lead. J. C. CHASTON (Royal Tech. College, Glasgow) *Metal Treatment*, Vol. 3, Spring 1937, pp. 34-38. Review, with theoretical discussion, of recrystallization and creep phenomena. Although after heavy deformation Pb is nearly completely self-annealing, it can retain appreciable amounts of work hardening if changes in shape are small. It is suggested that in creep, under small loads, initial rapid elongation takes place by crystal slip, ceasing as work hardening occurs. Then, when all slip planes are harder than the boundaries, further elongation occurs at a constant rate by boundary movement until necking makes its appearance, when there is a rapid yield to failure. 7 references. JCC (11a)

The Influence of Small Additions on the Recovery Temperature, Grain Size, and Hardness of Lead (Ueber den Einfluss geringer Zusatze auf die Erholungstemperatur, Korngrosse, und Harte des Bleis) E. JENCKEL & H. HAMMES (Kaiser Wilhelm Inst. phys. Chem. Elektrochem). *Z. Metallkunde*, Vol. 29, Mar. 1937, pp. 89-94. Original research. The effect of 0.1% additions of 17 different metals on the recovery temperature of the Brinell hardness of Pb was studied. Those metals which formed intermetallic compounds were especially effective, Ca and Li raising the recovery temperature to 160° C., while those metals that form no compounds with Pb have little effect. Within the solid solubility limit of the addition element the effect is especially great, according to experiments with Mg and Te; this is interpreted as due to the binding forces of the addition element. On the other hand, grain refinement, especially at high temperatures, is caused only by additions beyond the solubility limit. Hardness values are reported for the cast alloys. GD (11a)

The Heats of Formation of Some Metallic Systems, Calculated from the Electrochemical Measurements of A. Oelander (Ueber die Bildungswärmen einiger metallischer Systeme, berechnet aus elektrochemischen Messungen A. Oelander's) F. WEIBKE (Tech. Hochschule, Hannover) *Z. Metallkunde*, Vol. 29, Mar. 1937, pp. 79-84. Thermodynamic application of data obtained by Oelander. Methods of calculating heats of formation for alloy systems from electrode potentials and their temperature coefficients are demonstrated and applied to the Cd-Sb, Bi-Tl, Ag-Cd, Au-Cd, and Cu-Zn systems. The stability of intermediate phases (as measured by heats of formation) agrees qualitatively with that predicted from the liquidus lines of the equilibrium diagram. The calculated values for Cu-Zn are in good agreement with calorimetric data. GD (11a)

Dark Areas in Aluminum Alloy Castings. I. TUTOV. *Metallurg*, Vol. 12, Feb. 1937, pp. 93-100. In Russian. In the upper portions of Al alloy castings which were machined, one sees occasionally, dull areas corresponding to localized porosity. Left in air for a few days they develop a whitish coating around them. These areas are so strongly affected by water that the white coating can be seen within 1-2 hrs. after wetting. A series of experiments showed that the reason for their formation is the presence of small amounts of P. It forms a solid solution with the alloying elements present at the grain boundaries. The solution easily decomposes with the formation of gaseous P compounds. (11a)

Indium-containing Silver Alloys (Indiumhaltige Silberlegierungen) E. RAUB & H. ROTERS. *Mitt. Forschung.-Inst. Probieramts Edelmetalle*, Vol. 11, May/June 1937, pp. 13-19. Original research. Definitely establishes the value of additions of In to Ag and Ag-Cu alloys with regard to mechanical and physical properties. Unlike Ag, metallic In is resistant to S compounds. It is extremely soft and can be kneaded between fingers; m-p. is 154.4° C. Small In contents do not appreciably affect the workability of Ag and Ag-Cu alloys but 20% and more In reduces it considerably, and also induces a tendency to hot-brittleness. In is without effect on the resistance of Ag and Ag-Cu alloys against tarnishing by S compounds. In reduces resistance of Ag to acids though not quite so much as Cu. Addition of In is of no practical advantage in increasing resistance against tarnishing or acids. Ha (11a)

The Preparation of Highly Reflecting Surfaces with Aluminum (Aluminium Zur Herstellung hochspiegelnder Oberflächen) H. VON KLUBER (Astrophysikalisches Observatorium Potsdam) *Metallwirtschaft*, Vol. 16, Apr. 16, 1937, pp. 370-372. Practical. Briefly describes apparatus for the vacuum distillation of metals onto glass surfaces. Al mirrors are compared with those of Ag; Al has as great a reflectivity as Ag in the range of visible wave lengths and greater reflectivity in the ultra violet region. Al mirrors are much more stable than Ag. GA (11a)

Protective Action of Beryllium in Remelting Magnesium Chips. L. SHPOLANSKI. *Metallurg*, Vol. 12, Feb. 1937, pp. 101-102. In Russian. Remelting Mg chips can be done with a 2-3% loss of metal and about 1% flux consumption, provided the metal contains 0.05-0.2% Be. (11a)

Experiences with Electric Resistors of Iron-chromium-aluminum Alloys at High Temperatures (Erfahrungen mit Heizleitern aus Eisen-Chrom-Aluminium-Legierungen bei hohen Temperaturen) R. RUMLER. *Elektrowärme*, Vol. 7, Apr. 1937, pp. 69-74. Original research. Cr-Al-Co-Fe alloys (Kanthal) and Cr-Al-Fe alloys (Megapyr) can be used even at the high temperatures required for glass and ceramic processes; the Fe-Cr-Al group is especially suitable in the range from 1250°-1350° C. provided the conductors are properly shaped and supported. The effect of shape, arrangement of the heaters, of gases and other substances on the temperature and life of the heaters is given in curves and photographs. Ha (11a)

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On **Metallic Scandium (Ueber das metallische Scandium)** WERNER FISCHER & KARL BRÜNGER & HANS GRIENEISEN. *Z. anorg. allgem. Chem.*, Vol. 231, Mar. 8, 1937, pp. 54-62. A method is described for preparing metallic Sc by electrolysis of molten $ScCl_3$-KCl-LiCl salt mixture using molten Zn as the cathode from which the Sc is later recovered by vacuum distillation. An oxide impurity of 0.1% could not be avoided. The melting point of Sc is about 1400° C.; the density, corrected for oxide impurity, is 3.1 g. per cm.^{3} and the atomic volume 14.5 cm.^{3} HFK (11a)

6

Paramagnetism in the System Sodium-mercury (Ueber den Paramagnetismus in System Natrium-Quecksilber) WALTER FRANKE & HELMUT KATZ. (Kaiser-Wilhelm Inst., Heidelberg) *Z. anorg. allgem. Chem.*, Vol. 231, Mar. 8, 1937, pp. 63-65. The magnetic susceptibilities of Na-Hg alloys were measured. The slight paramagnetism of these alloys is shown to be due to that of metallic sodium. The sodium is not dissolved in the form of atoms but rather in a state similar to its existence in a concentrated solution of Na in liquid ammonia. HFK (11a)

7

Refined Aluminum. TAKAYASU HARADA. *Suiyokwai-Shi*, Vol. 9, Feb. 1937, pp. 169-174. In Japanese. Original research. The refined Al produced by a French company was analyzed for Ba, Na and O_2 and found to contain less of these than Al produced by the Hoope process in America. Melting behavior, specific gravity, conductivity, mechanical properties, corrosion-resistance and anodic oxidation properties are recorded. HN (11a)

8

Special Brasses. C. H. S. TUPHOLME. *Can. Chem. Met.*, Vol. 21, May 1937, pp. 190, 192. Reviews free-cutting, stamping, high-tensile and "temper-hardening" brasses. WHB (11a)

9

Resistance Measurements on Boron and Silicon Carbides (Widerstandsmessungen am Bor und am Siliciumkarbid) F. P. HENNINGER. *Ann. Physik.*, Vol. 28, Feb. 1937, pp. 245-263. Very exact investigation of B of 99.97 and 99.7% purity showed that the high value of electric resistance and its temperature coefficient are not true values but are caused by valve layer action between crystals and molecules. The apparent resistance of 830,000 ohm of the specimen decreased, under a suitable test, to 3.6 ohm corresponding to a specific resistance of 0.25 ohm/cm.^{3} This was corroborated by comparison with the analogous behavior of silicon carbide. Ha (11a)

10

Magnetic Properties of Rare Metals (Les Propriétés Magnétiques des Métaux Rares) F. TROMBE (Univ. Strassburg) *Ann. Physique*, Vol. 7, Mar. 1937, pp. 385-419. Extensive research on La, Ce, Nd, Ga and some of their salts. La shows a slight paramagnetism, which decreases with rising temperatures, $\chi = 1.19 \times 10^{-6}$ at 16° C. and Ce ($\chi = 17.6 \times 10^{-6}$ at 16° C.) shows complicated magnetic properties at low temperatures. Nd follows the Weiss law and has a Curie point at 10° K. Ga containing less than .03% Fe exhibits very remarkable magnetic properties. Its Curie point is at 16° C. and its ferromagnetism increases markedly with decreasing temperature. At 0° K., the specific magnetization of Gd is 253.5 C.G.S. and surpasses that of Fe (221.7 C.G.S.). The atomic moment of Gd is more than 3 × that of Fe. Below the Curie point Gd is paramagnetic and obeys the Weiss rule in the temperature range of 90°-366° C. 30 references. EF (11a)

Lead and Cadmium Bearing Metals Containing Nickel (Nickelhaltige Blei- und Kadmiumlagermetalle) B. TRAUTMANN. *Nickel Berichte*, Vol. 7, Mar. 1937, pp. 37-39. A review based mainly on findings of Swartz & Phillips and Ackermann. Physical properties are presented in 3 tables and 3 diagrams. EF (11a)

Non-corrodible Bronze. *J. Comm. Shipbldg. & Eng. Ed.*, May 20, 1937, p. 7. Description of a new Cu-Al-Si non-corrodible alloy. A very high resistance to corrosion is attained by avoiding the introduction of small local elements which produce local potential differences and the influence of Al on the resistance to corrosion appears to be due to segregation of secondary products in the boundary layers. JWD (11a)

The Failure of Lead by Creep. J. NEILL GREENWOOD. *Proc. Australasian Inst. Mining & Met.*, No. 100, Dec. 31, 1935, pp. 477-497. Original research. Pb can fail by intercrystalline cracking by the application of a steady stress in air. At operating stresses it is probable that this cracking would be accompanied by less general distortion than is found at 500 lb./in.^{2} Therefore, the possibility of failure is not remote even in the absence of vibration or corroding liquids. Minute increases in Ag, Zn, Bi, Sb, and Te increase the creep rate of commercial Pb under stress of 500 lb./in.^{2} At 100 lb./in.^{2} an increase of 50° increases creep rate about 50%, at 200 lb./in.^{2}, 300%. **AHE (11a)**

Investigations on Bismuth Crystals. III. Thermal and Electric Conductivity at the Transition from Transverse to Longitudinal Magnetic Field (Untersuchungen an Wismutkristallen. III. Wärme- und Elektrizitätsleitung beim Uebergang von transversalem zu longitudinalem Magnetfeld) E. GRÜNEISEN & J. GIELESSEN. *Ann. Physik.,* Vol. 28, Feb. 1937, pp. 225-239. Original research. The relations between electric and thermal conductivity and their absolute values were determined from —195° to room temperatures, and in magnetic fields from 650 to 6100 oersteds. It was found that the electric conductivity is no definite function of the thermal conductivity. 5 references. See *Metals and Alloys,* Vol. 8, Jan. 1937, p. MA 36R/1. Ha (11a)

Pattern Alloy Is Nonshrinking. *Foundry,* Vol. 65, Mar. 1937, p. 96. Describes a new Bi-Pb alloy used for duplicating wood master patterns in constructing Al matchplates. It melts at 225° F. Recommends pouring temp. of 310° F. for long, thin castings and 270° F. for thick, solid castings. Claims that due to its nonshrinking properties and fluidity, the alloy reproduces accurately the fine detail of ornamental master patterns. It was developed by Cerro de Pasco Copper Corp. VSP (11a)

Change of Electric Resistance and Reflecting Power of Metallic Mirrors Condensed at a Low Temperature (Die Änderung des elektrischen Widerstandes und des Reflexionsvermögens von bei tiefer Temperatur kondensierten Metallspiegeln) R. SUHRMANN & G. BARTH. *Z. tech. Physik,* Vol. 16, Nov. 1935, pp. 449-451. Original research. Various metal vapors were condensed on plates of amorphous quartz in vacuo at 20° abs. (Ag, Au, Cd, Cu) or at 80° abs. (Pb, Tl, Bi). The abnormally high electric resistivity of the resulting very thin deposits of all investigated metals, except Bi, decreased and their reflecting power increased upon subsequent gradual heating to room temperature. The effect of temperature on either property was greater with Ag, Au, Cd, and Cu than with Pb and Tl. The electric resistivity of Bi deposits increased upon subsequent heating. The observed changes of electrical resistivity may be attributed to an increase of the degree of order in the crystal lattice of the deposited metal. ORS (11a)

Reflecting Power of the Copper-nickel Alloys (Das Reflexionsvermögen der binären Mischkristallreihe Kupfer-Nickel) P. BERGMANN & W. GUERTLER. *Z. tech. Physik,* Vol. 16, Aug. 1935, pp. 235-237. Original research. The reflecting power of 9 Cu-Ni alloys with 0.100% Ni for light of 4 different wavelengths between 4670 and 6100 A.U. was determined with a spectral photometer. The strong selectivity of the reflecting power of pure Cu decreases greatly with increasing Ni content, the alloys with 25-100% Ni having the same reflecting power as pure Ni. No relation could be established between the behavior of the reflecting power and that of other physical properties of Cu-Ni alloys. ORS (11a)

Particle Size and Magnetic Susceptibility (Teilchengrösse und magnetische Suszeptibilität) SS. BHATNAGAR, M. R. VERMA & M. ANWAR-UL-HAQ (Punjab Univ., India) *Kolloid-Z.,* Vol. 78, Jan. 1937, pp. 9-18. Review plus original research. The magnetic susceptibilities of Pb, Cu, S, Se, Te, Bi and Sb in the form of 0.4 μ particles were measured and found to be substantially the same as those of the respective compact materials. Previous work by others showing a possible relationship between particle size and susceptibility is believed to have been erroneous owing to contamination of the powder with oxides and hydroxides. FPP (11a)

Is There a Metallic Conductivity in Highly Compressed Metal Vapors? (Gibt es in hochkomprimierten Metalldämpfen eine metallische Leitfähigkeit?) WERNER BRAUNBEK. *Z. tech. Physik,* Vol. 16, Nov. 1935, pp. 497-498. Original research. Electric conductivity measurements on Hg vapor at 500° to 730° C., 0.45 to 35.5 atm., and on K vapor at 1130° to 1200° C., 5.0 to 10.0 atm. indicate that in both vapors the conduction is largely due to thermal factors, the "metallic" conductivity of Hg vapor at 730° C., 35.5 atm. and of K vapor at 1200° C., 10 atm. being of the order of magnitude of, at most, 10^{-33} and 10^{-7} ohm^{-1} $cm.^{-1}$, respectively. ORS (11a)

Structure of Thin Metal Films Formed by Condensation at Low Temperatures (Ueber die Struktur dünner bei tiefen Temperaturen kondensierter Metallschichten) G. HASS. *Naturwissenschaften,* Vol. 25, Apr. 9, 1937, pp. 232-233. Original research. Thin films formed by condensation at low temperatures have an unusually high electrical resistance and a very low optical reflection. Using electron interference, films of Ag and Sb were investigated. When brought to room temperature, the films showed increased electrical conductivity and optical reflection. This was accompanied by recrystallization, but, contrary to the results of other workers, no amorphous films were found and no definite temperature of transformation could be determined. JZB (11a)

11b. Ferrous

V. V. KENDALL, SECTION EDITOR

1 **Modern Developments in Constructional Steels.** E. H. SCHULTZ. *Metal Treatment,* Vol. 3, Spring 1937, pp. 39-42. Translation from *Maschinenbau der Betrieb.* Discusses age-hardening Cu and other steels, diminishing significance attached to ultimate tensile strength and endurance limit for service prediction, and improvements in properties through manufacturing modifications. JCC (11b)

2 **Some Physical and Mechanical Properties of Very Pure Steels (Sur Quelques Propriétés Physiques et Mécaniques des Aciers Très Purs)** W. BRONIEWSKI, S. PRZEDPELSKI & S. SULOWSKI. *Compt. Rend.,* Vol. 204, June 21, 1937, pp. 1874-1876. Original research. Curves are drawn to show the change in physical and mechanical properties of a series of steels with the C content varying from that of a very mild steel to 2%. The other impurities were extremely low: 0.010% Si, trace Mn, 0.002% P, 0.0005% S. The steel was drawn into wire and cooled over a period of 10 hrs. from 900° to 600° C. FHC (11b)

3 **Physical and Mechanical Properties of Pure Fe as a Function of Cold Working (Sur les Propriétés Physiques et Mécaniques du Fer Pur en Fonction de l'Écrouissage)** W. BRONIEWSKI & I. ST. GLOTZ. *Compt. Rend.,* Vol. 204, May 19, 1937, pp. 1473-1475. Curves are drawn to show the variation of magnetic and mechanical properties with different amounts of drawing of an Fe wire of high purity such that the P = 0.004% and S = 0.001%. FHC (11b)

4 **Isothermal Transformation of Austenite.** E. TOVPENETZ. *Metallurg,* Vol. 12, Feb. 1937, pp. 61-65. In Russian. Original research. Steels containing 0.35% C, 1.11 Cr, 0.15 Ni, 0.13 V, 0.27 Mo; 0.32 C, 0.70 Cr, 3.37 Ni, 0.35 Mo; and 0.37 C, 2.44 Cr, 1.38 Ni, 0.35 Mo, were studied by heating at 860° C., keeping in magnetometer until the desired amount of decomposition occurred, quenching and determining hardness and microstructure. (11b)

5 **Heat-treatment of Wear-resisting Gray Iron (Wärmebehandlung von verschleissfestem Grauguss)** R. HANEL. *Giesserei,* Vol. 24, Mar. 26, 1937, pp. 149-153. The characteristic properties of cast Fe as dependent on its structure and the factors by which heat treatment produces hardening are explained. The martensitic structure, which must be present for hardening, can be produced by a transformation at 200°-250° C. by quick cooling, or cooling and alloying, or alloying alone, or by alloying alone for austenite formation and subsequent heat-treatment. These conditions are discussed in detail and curves given showing hardness as function of temperature of heat treatment and alloying elements. 4 references. Ha (11b)

6 **Non-aging Steels (Alterungsbeständige Stähl)** *Montan. Rundschau,* Vol. 29, Apr. 16, 1937, pp. 5-7. A. Frey has developed an unalloyed non-aging steel that does not have the usual rigid specifications in regard to P, S, and O_2 content, and that does not require the expensive deoxidation customary for non-aging steels. After a 10% cold deformation followed by annealing this steel does not exhibit the customary aging characteristics, and it retains the required physical properties. From 0° to 500° C. the physical properties are very much the same as for an ordinary low C steel. The customary increase in tensile strength found for ordinary steel at about 250° C. is not very pronounced in the new steel. Its corrosion resistance is about the same as for a low C steel. Its resistance to alkaline embrittlement and to fissuring when in contact with boiler water and alkaline solutions is considerably higher. It welds well, but the weld does not possess age resistant properties except when water gas is used in welding. Riveted connections exhibit age resistant properties. [Analysis of steel is not given.] BHS (11b)

7 **Vanadium Steels for the Oil Industry.** JEROME STRAUSS & A. W. DEMMLER. *Preprint, Am. Petroleum Inst.,* Chicago, Nov. 1936, 8 pp. Survey of the characteristics of V steels and irons used in, or available for use in the oil industry, with data on chemical and physical properties. The uniformity of these steels and their contribution to useful strength and ability to withstand abuse warrant their greater utilization. Applications of various V alloy steels to several types of oil-field equipment are given. VVK (11b)

8 **New Concepts of Metallurgical Control in Automotive Steels.** O. N. PETERSON (Buick Motor Co.) *Steel,* Vol. 100, June 14, 1937, pp. 36-39, 72. Discusses details involved in metallurgical control of steels used in vital parts of Buick automobiles, with much attention to transmission and differential gears. MS (11b)

Magnetic Properties of Iron-zinc Alloys (Propriétés Magnétiques des Alliages de Fer et de Zinc) M. FALLOT (Univ. Strassburg) *Ann. Phys.*, Vol. 7, Series 11, Mar. 1937, pp. 420-428. Original research on Fe-Zn alloys containing 0-17% Zn. Due to the high vapor pressure of Zn, the alloys were melted in N at a pressure of 125 atm.; they were annealed for 36 hours at 600-900° C. The magnetic transformation point of Fe-rich Fe-Zn alloys is rapidly depressed by the addition of Zn at a rate of 6° C./1 at. % Zn. The mean ferro-magnetic moments decrease with rising Zn concentrations. Traces of Zn reduce the mean atomic moment of Fe to a much smaller degree than most elements. EF (11b)

Manufacture and Application of Modern Cast Irons. J. W. GARDOM. *Trans. Manchester Assoc. Engrs.*, Session 1935-1936, pp. 297-329. With discussion. Review. Production of high-grade cast Fe as obtained by modern melting and molding processes, is reviewed with regard to high strength, fatigue resistance, wear and abrasion resistance. These properties can be obtained in the "as cast" condition or cast and modified by suitable heat-treatment. Possible economies are discussed. Ha (11b)

The Directional Distribution of Radiation and Reflection of Heat Rays from Commercially Important Surfaces (Die Richtungsverteilung von Ausstrahlung und Rückwurf von Wärmestrahlen an technisch wichtigen Oberflächen) DR. E. ECKERT. *Arch. Wärmewirt.*, Vol. 18, Apr. 1937, pp. 107-108. Original research. In most heat exchange calculations, it is assumed that the direction of the radiated energy and usually also of the reflected rays can be computed from the Lambert cosine law. Polar diagrams for Al-bronze, Fe with and without mill scale, Cu oxide, cast Fe and other materials show that other laws are followed. JZB (11b)

Alloying Cupola Gray Cast Iron. F. E. FISHER (Sloss-Sheffield Steel & Iron Co.) *Iron Age*, Vol. 139, Apr. 29, 1937, pp. 43-45, 123, 124. General review of the properties, uses and effect of alloys, such as Cr, Mn, Cu, Mo, Ni, Si, Ti, V, Zr and P, on cupola gray cast Fe. Includes table showing amount of alloying material to add to each 100 lb. of metal and another table listing the approximate analysis to use for each of the 61 different applications of gray cast Fe. VSP (11b)

Is Cast Iron a Brittle Material? (Ist Gusseisen ein spröder Werkstoff?) G. MEYERSBERG. *Giesserei*, Vol. 24, Jan. 15, 1937, pp. 28-31. Review. The terms "brittle" and "tough" are defined as they refer to deformation just before fracture; brittleness means that this deformation is little—toughness, that it is large. No sharp demarcation exists between brittleness and toughness; there is a gradual transition from one to the other property. Actually brittle materials are according to this definition, glass and porcelain, while cast Fe has with such brittle materials only one property in common, namely the brittle behavior under static stress. As, however, cast Fe shows a certain plastic deformation which does not occur in brittle materials, it can not be classed among these. 11 references. Ha (11b)

Cast Iron and Its Applications in Engineering. A. CAMPION. *Foundry Trade J.*, Vol. 56, 1937. Feb. 18, pp. 153-156, 158; Feb. 25, pp. 172-174. Review. With strength approaching 40 tons/in.^{2} and a Brinell hardness of 500, cast Fe is displacing forged steel in parts where a short time ago it would have been considered impossible; cast automotive camshafts and crankshafts are important recent developments. The particular type of high-test iron made by Meehan's process and known as "Meehanite" can be controlled to meet definite service requirements; mechanical properties of this type of Fe are given. Fatigue strength, determination of damping capacity, heat-resisting irons, and heat-treated cast irons are also discussed. AIK (11b)

A Special Aging Phenomenon in Alloy Steel. KEIITI OTA (Japan Steel Mills Co., Ltd.) *Tetsu-to-Hagane*, Vol. 23, Apr. 25, 1937, pp. 354-359. In Japanese. Original research. The special aging phenomenon consists in aging tensile specimens for a few days to produce an increase in elongation and reduction of area without change in tensile strength. From this investigation it was found that (1) this aging phenomenon appears distinctly in tension test but less distinctly in impact test, (2) by heating the specimens even at 100°C a change in the result of the above tests occurs, (3) the larger the cross-sectional area, the longer is the time of heating required for the elimination of the aging, (4) if proper control is kept on time and temperature of heating, the elongation and reduction of area of the steel in cast condition can be improved over those in forged condition, (5) this aging phenomenon appears most noticeably when steel forging contains flakes, (6) hydrogen content in steel differs by the degree of aging, (7) mechanical properties, H content, and the appearance of fracture of aged specimens may be regained by heating in H_2 for 1 hr. at 500°C. NS (11b)

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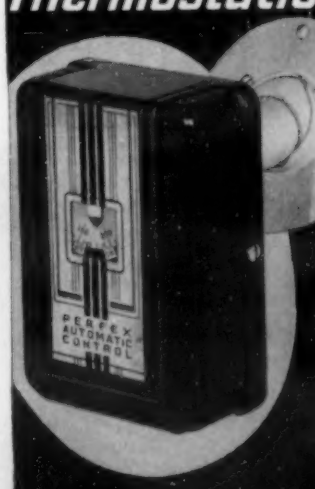

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12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor

H. C. CROSS, SECTION EDITOR

Long Time Creep Tests of 18 Cr 8 Ni Steel K 19 and 0.35 C Steel K 20. H. C. CROSS & J. G. LOWTHER (Battelle Mem. Inst.) *Trans. Am. Soc. Mech. Engrs.*, Vol. 59, July 1937, pp. 441-445. Original research. Long-time creep tests on 18/8 steel at 8345 lbs./in.^{2} and at 1200° F. show increasing rates of creep and greater total deformations than obtained by extrapolation from 2000 hr. test period. 0.35% C steel tested at 850° F. shows lower creep rate and lower total deformation than by extrapolation from 2000 hrs. The former showed carbide precipitation after creep test, while the 0.35% C steel showed little change in either structure or impact resistance from the heat-treated condition. Ha (12)

Constant Strain-rate Tests on 0.35 C Steel K 20 at 850° F. A. NADAI & E. A. DAVIS (Westinghouse Elec. & Mfg. Co.) *Trans. Am. Soc. Mech. Engrs.*, Vol. 59, July 1937, pp. 447-450 Original research. Correlation of test results with long-time and accelerated tests was investigated further. Plotting the yield stress σ at a given strain ϵ against the logarithm of the plastic strain-rate u" gave curves that checked well with the long-time tests described in the previous abstract. Ha (12)

Cooperative Creep Tests on 0.35 C Steel K 20 at 850° F. and 7500 Lbs./Sq. In. C. L. CLARK (Dept. Engrg. Research, Univ. Mich.) *Trans. Am. Soc. Mech. Engrs.*, Vol. 59, July 1937, pp. 439-440. Survey. Time-elongation curves and creep-rates determined by 8 cooperating laboratories are given. Ha (12)

A Relaxation Test on 0.35 C Steel K 20. E. L. ROBINSON (Gen. Elec. Co.) *Trans. Am. Soc. Mech. Engrs.*, Vol. 59, July 1936, pp. 451-452. Original research. Flow-rate (step-down stress) tests permitted the development of formulas for plastic and elastic extension, which showed that the results based on 2 or 3 mo. testing may be safely extended to a year or 10,000 hr. The relation between final stress and the corresponding rate of creep is a good index of the long-time behavior of the material. Ha (12)

Relaxation Tests on 0.35 C Steel K 20 at 850° F. N. L. MOCHEL (Westinghouse Elec. & Mfg. Co.) *Trans. Am. Soc. Mech. Engrs.*, Vol. 59, July 1937, pp. 453-455. Original research. Equipment described. From tests at three stresses curves of relaxation of stress against time were plotted from permanent deformations measured. While results were erratic, load-carrying ability of the steel was measured. Ha + HCC (12)

Measurements of the Latent Heat of Tin in Passing from the Supraconductive State at Constant Temperature. W. H. KEESOM & P. H. VAN LAER (Kamerling Onnes Lab., Leiden) *Proc. Koninkl. Akad. Wetenschappen Amsterdam*, Vol. 40, No. 5, 1937, pp. 390. In English. Original research. The transition process from the supraconductive to the non-supraconductive state is reversible. The disturbance of the supraconductivity, as indicated by caloric effects, occurred at the same critical fields which are characteristic of resistance and induction phenomena. The existence of an intermediate state is assumed. EF (12)

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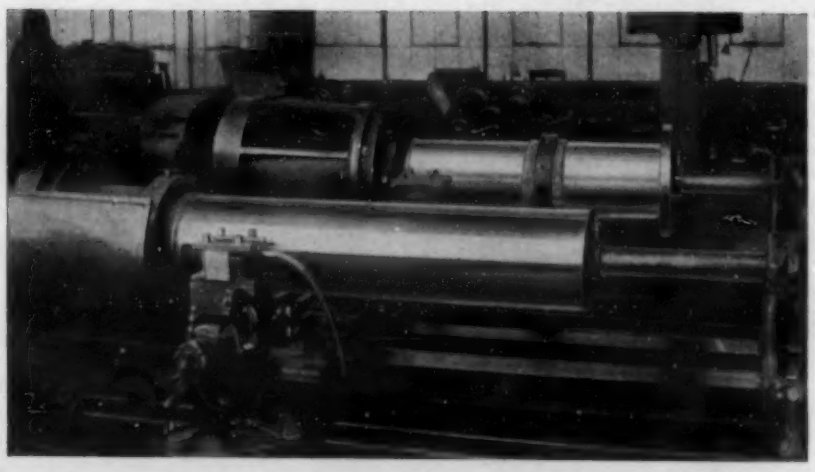

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Effect of Temperature on the Properties of Metals, Report of Joint Research Committee. H. J. FRENCH, Chairman. *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 28 pp. Contributions and organization of the committee are given. Research projects now in progress include: No. 10 on Testing of Tubular Members at Elevated Temperatures at Mass. Inst. of Tech., No. 11 on Assembly and Interpretation of Available Creep Test Data at the Univ. Michigan, No. 12 on Long-time Creep Tests on Carbon Steel (K20) at Battelle Mem. Inst., No. 13 on Investigations of the Properties of Metals at Low Temperatures, No. 14 on Revision of Tentative Method E 22-35 T, No. 15 on Torsion-creep Tests for Comparison with Tension-creep Tests No. 16 on Relaxation Tests, No. 17 on Study of High-temperature Life-test Methods and No. 18 on Study of Effects of Manufacturing Variables on the Creep Resistance of Steels. Proposed revisions of Tentative Method of Test for Short-time High-temperature Tension Tests of Metallic Materials (E 21-34 T) are given. For previous report see also *Metals and Alloys*, Vol. 8, July 1937, p. MA 438L/2. **Appendix III Report on Long-time Creep Tests of 18 Per Cent Chromium, 8 Per Cent Nickel Steel and 0.35 Per Cent Carbon Steel.** HOWARD C. CROSS & J. G. LOWTHER. Continuing progress report on the same long-time creep tests previously reported (*Metals and Alloys,* Vol. 7, July 1936, p. MA 369L/2; Vol. 8, July 1937, p. MA 438L/4; *Trans. A. S. M. E.,* Vol. 59, July 1937, pp. 441-445). The long-time creep tests on the 18-8 steel at 8345 lbs./in.^{2} at 1200° F. showed increasing rates of creep, thereby increasing the difference between the actual deformations measured and the values obtained by extrapolation from the 2000-hr. test period. The long-time creep tests on the 0.35% C steel at 8000 and 7500 lbs./in.^{2} at 850° F. continue to indicate extrapolation from the 2000-hr. period conservative as compared with the actual deformation measured. The data further confirm the conclusion that for dependable extrapolations, knowledge of the strain-hardening characteristics of the materials is essential. Experiments on both the 18-8 and the 0.35 C steel on unloading, holding at temperature with zero load, reloading, and again unloading indicate that practically all of the deformation subsequent to that measured upon application of the load at the start of the test is permanent and not recoverable. **Appendix IV Discrepancies in the Load-carrying Abilities of Carbon Steels at 850° F.** H. W. GILLETT. Unexplained discrepancies in published data are reviewed. The method of melting, the McQuaid-Ehn grain size, and grain-coarsening treatments all seem to bear some relation to high-temperature performance. The behavior of rimmed steel as compared with fully killed steel and the carry-over of creep resistance or its lack in both the cast and the rolled condition, also point to the grain-coarsening properties of the steel and to the melting and deoxidation practice which controls them, as worthy of attention in connection with the problem of producion of creep-resistant steels. While greater refinement in methods of creep testing and more knowledge of the effect of multidimensional stress and the like in high-temperature problems are needed, attention should not be confined to such matters to the neglect of the steel-making variables that produce a ten-fold variation in creep behavior of killed steels and a hundred-fold variation between killed and rimmed steels. VVK (12)

Interpretation and Use of Creep Results. J. J. KANTER (Crane Co.) *Trans. Am. Soc. Metals,* Vol. 24, Dec. 1936, pp. 870-910. With discussion. Review. Creep viscosity appears to decrease exponentially with increase of stress. Thus the constant creep rate varies with stress. Materials for high temperature service should be selected on basis of creep tests showing position on the temperature scale with regard to working stress. Working stress should be based on total deformation tolerable during life of material. GEG (12)

Creep Characteristics of Metals. C. L. CLARK & A. L. WHITE (Univ. Michigan) *Trans. Am. Soc. Metals,* Vol. 24, Dec. 1936, pp. 831-868. With discussion. Original research. Definition of creep and the various factors influencing crep resistance. Variations in the past history of the material influence creep resistance more than other physical properties. Therefore, creep data should not be compared unless past history is known to be the same. GEG (12)

The Thermal Expansion of the Bi Lattice Between 25° and 530° Abs. ROBERT B. JACOBS & ALEXANDER GOETZ (Calif. Inst. Tech.) *Phys. Rev.,* Vol. 51, Feb. 1, 1937, pp. 159-164. Original research. The thermal expansion of the lattice of Bi crystals between 25° and 530° abs. (—248 and +257° C.) is measured with a Bragg spectrometer equipped with a movable slit between crystal and ionization chamber. The expansion varies from 8.3×10^{-6} at 25° abs. (—248° C.) to 17.4×10^{-6} at 120° abs. (—153° C.); beyond the latter temperature it stays unchanged until the melting point, except for the range —15° to +75° C. where the expansion coefficient drops to 13.8×10^{-6}. WAT (12)

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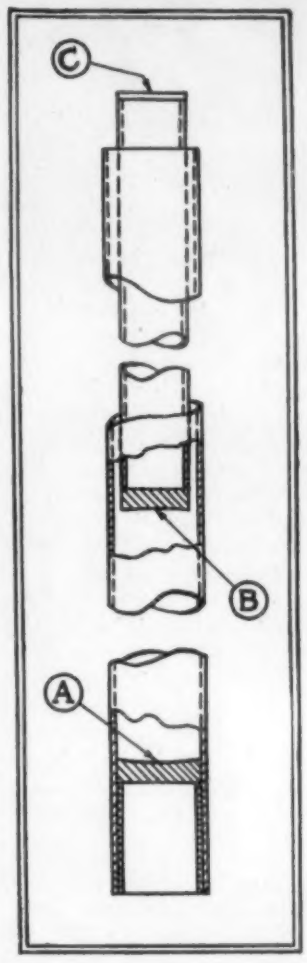

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The Relaxation of Copper at Normal and at Elevated Temperatures. JOHN BOYD. *Am. Soc. Testing Material,* Preprint for June 1937 meeting, 15 pp. Original research. As increasing amounts of information on the subject of creep are accumulated, relaxation, a manifestation of creep, is beginning to attract more and more attention. The phenomenon of relaxation is exhibited when a material is stretched to, and then held at, a given extension. Creep immediately begins to take place, and this tendency to elongate causes the stress within the material to decrease. A knowledge of the laws which govern the decrease of stress should be of much practical interest, but in addition it should also bring about a clarification and an extension of the whole picture of creep. The present paper is intended to present an approach to the problem of relaxation based on general principles. To obtain the experimental data a special automatic machine was designed and built. Cu was employed in testing because, being a fairly pure material, its use seemed to present a means of studying the problem without giving rise to involved additional effects. The relaxation of Cu at room temperature and probably up to about 200° C. may, for practical purposes, be represented by an expression of the form: $\sigma = \sigma^* (1 - A \log (1 + Bt))$ where $\sigma =$ the stress at any time t; $\sigma^* =$ the initial stress, and A and B are constants. A marked increase in relaxation takes place when the temperature is raised above about 80° C. At 200° C. the stress is estimated to fall to about 20 to 25% of its initial value in a service time of 20 yrs. Recovery effects tend to decrease the creep rate found in the early part of a relaxation test. The dissimilarity between the speed laws for decreasing and for increasing stress gives rise to rather large amounts of relaxation. VVK (12)

A Comparison of the Methods Used for Interpreting Creep Test Data. JOSEPH MARIN (Rutgers Univ.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 7 pp. Review. There have been a number of methods developed for interpreting tension creep test data for the purpose of determining working stresses. All methods require extrapolation of test results beyond times covered by the tests. Various procedures have been used in making such extrapolations. This paper compares the working stress values as determined by the various methods. A comparison of results shows that there are appreciable difference in the working stresses as obtained by different methods of interpretation. VVK (12)

13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

Corrosion Testing Methods for Copper Alloys. D. K. CRAMPTON & N. W. MITCHELL (Chase Brass & Copper Co.) *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 11 pp.; *Metal Ind., London,* Vol. 51, July 9, 1937, pp. 35-39. Corrosion phenomena are classified according to causes and results. Corrosion tests should incorporate as many as possible of both the causes and the resultant forms of corrosion. It is shown that the alternate-immersion and water-line tests do incorporate many of the causes, and all of the forms of corrosion with their several variations. Tensile strength measurement is considered the best means of evaluating corrosion losses. Tensile strength measurement is subject to fewer errors and is related more closely to the amount of damage done to a specimen than loss of weight measurements. All factors affecting the reliability of test results should be controlled as closely as possible. With particular reference to the actual measurements, it is felt that the metal used for testing should be sufficiently uniform so that original tensile strength determinations of a group of specimens will have a standard deviation from the mean tensile strength value of not more than 2%. The standard deviation from the mean of a group of corroded specimens must be expected to be larger than this, but in all cases the standard deviation should be calculated and the accuracy of the final result, the percentage loss of tensile strength, should be noted. This deviation should be considered when estimating the relative corrosion behavior of two or more alloys. The more important part of corrosion testing is the interpretation of the results obtained. Careful examination should be made of all specimens tested, and the form of corrosion noted. Both the causes and the forms of corrosion should be taken carefully into consideration when applying the results of corrosion tests to service behavior. VVK + RWB (13)

The Wear of Iron Alloys by Mineral Materials (Ueber den Verschleiss von Eisenlegierungen auf mineralischen Stoffen). E. KNIPP. *Giesserei,* Vol. 24, Jan. 15, 1937, pp. 25-28. A new method of determining the wear of Fe and steel by mineral materials is described in which the loss in weight of the steel (in the shape of a cutting tool) is measured after it has been worked against a burnt magnesite brick for 3 min. with a cutting velocity of 40 r.p.m. and a feed of 5 mm./min. Curves show that the wear resistance of purely martensitic steels is hardly increased by C or Mn. Mo up to 1% reduces wear resistance independent of the C and Mn content of the steel. Cr increases the wear resistance considerably. Best resistance was found in a steel with 0.1% C and 0.3% Mn and about 1% Cr; 0.3% C and 3% Mn with 0.5% Cr was also good. No relation between Brinell hardness and wear resistance could be established with the alloys examined. Ha (13)

Determination of the Relative Resistance to Cavitation Erosion by the Vibratory Method. S. LOGAN KERR (United Eng. & Constructors, Inc.) *Trans. Am. Soc. Mech. Engrs.,* Vol. 59, July 1937, pp. 373-397. An investigation of the resistance of various metals to the erosive action of cavitation was made with particular regard to materials for construction of turbines, gates and other parts in large hydraulic units. As cavitation had previously been recognized as a mechanical rather than chemical action, a test method was developed by which water at high velocity was made to impinge, through a venturi-type nozzle, on the material, thus creating a vibratory action. The tests are described at length; general conclusions are drawn from the curves that show the behavior of steels, bronzes, brass and Cu in fresh and seawater. An important point in cavitation is an eventual chemical or electrolytic attack which leads to rapid deterioration. Cast-steel turbine runners cannot be protected with a local coating of Ni-Cr or other corrosion-resistant steel for service under seawater due to severe galvanic action between the two materials. Ha (13)

Pitting Resistance of Metals under Cavitation Conditions. J. M. MOUSSON (Safe Harbor Water Power Corp.) *Trans. Am. Soc. Mech. Engrs.,* Vol. 59, July 1937, pp. 399-408. Experimental apparatus and testing procedures are described to determine the pitting resistance of metallic materials under accelerated cavitation conditions; the results for plain and alloyed cast irons, cast and rolled alloyed steels, forged low alloy steels, stainless steels, brasses, bronzes and some special materials are given in full in tables to permit selection of a suitable material. Pitting is more liable to occur in summer than in winter, and more careful selection must be made in tropical climates where large temperature differences occur. 7 references. Ha (13)

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Theory of Passivity Phenomena XXX. Anodic Passivity Effects on Magnesium in Acid Solutions (Zur Theorie der Passivitätserscheinungen XXX. Über die anodische Passivitätserscheinungen an Magnesium in säuren Lösungen) W. J. MUELLER & E. NACHTIGALL (Techn. Hochschule, Wien) *Sitzber. Akad. Wiss. Wien, Math.-Naturw. Klasse, Abt. IIb,* Vol. 145, No. 7, 1936, pp. 607-616. Review plus original research. Whereas the Mg
2 electrode suspended in acids did not become passive in acids even at high current densities, the following observations were made on the covered electrode: Mg electrodes (.013% Si, .042% Al, .06% Mn, traces Zn, Fe, Cu) can be passivated in H_2SO_4. The current
— intensity/time curve closely resembles that obtained with other metals. Dropping the temperature from 20° to 0°C. materially shortens the time required for passivation. After long-time runs a very small amount of O_2 and H_2 is evolved. Lowering the pH
3 value by adding Mg ions up to ¾ of H_2SO_4 shortens the time for passivating. Reducing the H-ion concentration at constant sulphate ion concentration leads to unreliable testing results. During the process of passivation, a black protective coating is temporarily formed before the current intensity begins its marked drop.
— In neutral $MgSO_4$ solutions, no passivation occurs even at high current densities. A black coating forms without changes of current intensity. The black coating also develops in HCl, but no passivation occurs. In HNO_3 a marked drop of the current in-
4 tensity takes place at higher current densities. However this process is considerably disturbed by secondary reactions which make it impossible quantitatively to evaluate the testing results. See *Metals and Alloys,* Vol. 7, Jan. 1936, p. MA 34L/2. EF (13)

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Intercrystalline Corrosion of Fe-Ni-Cr-C Alloys Cold Worked after Quenching (Corrosion Intercristalline des Ferronickels Chromés, Carburés, Écrouis après Hypertrempe) PIERRE CHEVENARD & XAVIER WACHE. *Compt. Rend.,* Vol. 204, Apr. 19, 1937,
5 pp. 1167-1169. Original research. An alloy of 0.3% C, 37% Ni, 10% Cr, remainder Fe, was quenched in water from 1250° C., subjected to cold work and subsequently reheated to 750° C. for varying lengths of time from a few minutes to 100 hrs. The
— working of the sample after quenching increased the tendency towards intercrystalline corrosion. FHC (13)

New Researches on the Intercrystalline Corrosion of Chromium-Iron-Nickel (Nouvelles Recherches sur la Corrosion Intercristalline des Ferronickels Chromés) P. CHEVENARD. *Métaux et*
6 *Corrosion,* Vol. 11, Feb. 1937, pp. 23-31; **Recent Studies of Intergranular Corrosion in Nickel-chrome Steels.** P. CHEVENARD. *Wire & Wire Prod.,* Vol. 12, Sept. 1937, pp. 469-473, 494-495. Original
— research. Thermomagnetic and intercrystalline corrosion studies were made on Cr-Fe-Ni alloys types CN4 (22% Ni, 2% Cr, 0.5% C) and ATV (34% Ni, 11% Cr, 0.3% C). Alloy ATV is ferromagnetic
7 with a measurable Curie point at high temperatures. This alloy consists of an aggregate of austenite and rich Cr carbide and the distribution of Cr between the austenite and carbide depends upon treatment. The Curie point is lowered by the addition of Cr to Fe-Ni and the study of this point shows the amount of Cr dis-
— solved in austenite. Each carbide grain is surrounded by areas poor in Cr and C. The presence of these areas can be detected by a sulphur reagent made of hypo-liquor and HCl. Alloy ATV has good resistance to intercrystalline corrosion when used for turbine blades. A stabilizing treatment is necessary for these alloys
8 in order to reduce the heterogeneity. GTM + Ha (13)

Wear and Fatigue of Axle Steels. L. KUKANOV. *Metallurg,* Vol. 12, Feb. 1937, pp. 51-60. In Russian. A study of several steels containing 0.25-0.33% C, 0.69-1.20% Mn, and 0.04% Si,
— indicated that the wear resistance increases noticeably with increasing Mn content from 0.7-0.8% to 1.1-1.3% together with fatigue strength and resistance to the notch effect. (13)

Cavitation on Marine Propellers. L. P. SMITH (U. S. Navy) *Trans. Am. Soc. Mech. Engrs.,* Vol. 59, July 1937, pp. 409-431.
9 The effects of operating conditions of a propeller, thrust and torque, slip ratio and pressure, on cavitation were investigated. Building and laminar cavitation are distinguished, and the conditions for their occurrence are determined. 49 references. Ha (13)

—

Cadmium as an Auxiliary Plating. E. E. HALLS. *Metal Treatment,* Vol. 3, Spring 1937, pp. 27-33. Report of corrosion tests.
10 Outside exposure, salt spray, and varying humidity tests on threaded steel shafts finished with Zn, Cu + Ni, Cd + Ni, Cu + Ni + Cr, and Cd + Ni + Cr indicate that, where heavy Ni finishes are too costly, a medium Cd undercoat is beneficial. JCC (13)

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Yield Point (lbs. per sq. in.)	33,000 - 42,000
Elongation % in 2 inches	10 - 14
Red. of Area % in 2 inches	6 - 10
Brinell Hardness 3000 Kg. Load	167 - 179

Rockwell Hardness		85 - 87 - B
Scleroscope Hardness		26 - 28
Young's Modulus		14,350,000
Charpy Impact Value		17.4
Mean Analysis	% Copper	84.60
	% Aluminum	11.30
	% Iron	3.70
	% Special Agent	0.40
Weight lbs. per cubic inch		.270

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Methods of Studying Corrosion of Mg and Unprotected Light Alloys (Sur les Méthodes d'Essai à la Corrosion du Magnésium et des Alliages Ultralégers Non Protégés) JEAN COURNOT & LOUISE HALM. *Compt. Rend.*, Vol. 204, May 3, 1937, pp. 1333-1334. Report of French Aeronautical Commission on methods of studying marine corrosion of Mg and light alloys. Standards are set up for total immersion in salt solutions and for tests covering alternating immersion and removal of the sample from the solution. FHC (13)

Corrosion of an Assembly (La Corrosion des Assemblages) JEAN COURNOT & MARC BAUDRAND. *Compt. Rend.*, Vol. 204, May 24, 1937, pp. 1564-1566. Original research. Results are given showing the loss in weight due to corrosion of plates containing rivets of the following materials: (1) Light alloys of Al and Mg. (2) The same alloys Cd plated. (3) Stainless steel, 18-8 type. The corrosion resistance increased in the order of the three named. FHC (13)

Corrosion of Be Bronzes (Sur la Corrosion des Bronzes de Glucinium) HALDUN N. TEREM. *Compt. Rend.*, Vol. 204, May 10, 1937, pp. 1426-1428. Original research. The effect of chemical attack was noted on a series of cast bronzes containing 0.5 to 10% Be by the loss in weight method. Resistance to HCl and acetic acid was better than resistance to HNO_3, H_2SO_4, NaOH and NH_3. FHC (13)

New Acid Resisting Alloy. *Heat Treating Forging*, Vol. 23, June 1937, p. 284; *Blast Furnace Steel Plant*, Vol. 25, Sept. 1937, p. 1014. Brief description of "Hastelloy B." It is composed of Ni, Mo, and Fe. It is similar to "Hastelloy A" except that it has less Fe and more Mo. Withstands HCl in all concentrations and all temperatures including the boiling-point. In 20% HCl at boiling-point, rate of penetration of solution is 0.0016 in. per month. Physical properties are comparable to those of a good grade of alloy steel. It can be forged and rolled. MS (13)

Surmountable and Unsurmountable Difficulties in the Preservation of Metals (Ueberwindbare und unüberwindbare Schwierigkeiten bei der Sachwerterhaltung der Metalle) M. WERNER. *Metallwirtschaft*, Vol. 16, June 4, 1937, pp. 545-550. General discussion of metal corrosion from the standpoint of a consumer of metals. GA (13)

1 **Method for Studying Corrosion of Alloys (Méthode d'Etude de la Corrosion des Alliages)** HENRI TRICHÉ. *Compt. Rena.*, Vol. 204, Mar. 22, 1937, pp. 966-968. Original research. Extremely thin layers of metals may be identified by studying the spectra obtained when the spark from a Tesla high frequency coil strikes the surface of an alloy. Studies were made of the different spectra obtained from Cd-Bi alloys and from Al-Cu alloys before and after treatment in different acids. The spectra showed that Cd was attacked by certain acids before Bi so that less Cd was visible in the spectrum than in the alloy before treatment by acid. FHC (13)

2 **The Role of Oxygen in Corrosion (Le Rôle de l'oxygène dans la corrosion).** U. R. EVANS. *Métaux et Corrosion*, Vol. 12, Jan. 1937, pp. 5-6. A short review on the effect of oxygen on corrosion. Oxygen increases the corrosion of some metals and in increasing amounts, reduces the corrosion according to the 2-stage oxidation. Electrochemical corrosion may be more rapid than direct oxidation. 15 references. GTM (13)

3 **Engineering Principles Applied to Soil Corrosion Problems.** SCOTT EWING (Nat. Bur. Stds.). *Gas*, May 1937, pp. 23-24, 106-108. General review. In pipe line corrosion unrelated data, such as, pit depth measurements, service replacement and leaks records of water and oil lines are brought together into general scheme, permitting a mathematical treatment. Equation is worked out to calculate the most economical pipe wall thickness. It permits decision on economics of combating corrosion, whether by thicker wall thickness or with coatings. The desired properties of bituminous materials used for pipe coatings are discussed. HMW (13)

Abrasion of Cast Iron and the Effect of Various Elements Thereon. SHIRO KUSUNOSE (Mitsubishi Heavy Industry Co., Ltd.). *Tetsu to Hagane*, Vol. 23, Jan. 25, 1937, pp. 23-39. In Japanese. Original research to determine the kind of cast Fe that offers abrasion resistance and yet is economical. An abrasion testing machine is devised with which precise measurements are made, and from the results of which cast irons considered to have best compositions are prepared. Cast irons containing more than 3.5% C ($Si + C \geqq 5.5\%$) are remarkably less resistant as compared with 3% C ($Si + C \leqq 5.0\%$). In ordinary pearlitic irons abrasion resistance increases with the tensile strength. High C cast Fe (about 3.5% C) shows markedly increased resistance with an addition of P, but the increase is less in the case of low C cast Fe. Ni and Cr increase abrasion resistance. NS (13)

6 **Corrosion of Electron Alloys.** HACHIE SAWAMOTO. *Suiyokwai-Shi*, Vol. 9, Feb. 1937, pp. 179-188. In Japanese. Original research. The rate of corrosion of cast or heat-treated Electron alloys in dilute acid and NaCl solutions was compared by the measurement of the gases evolved. The specimens were heated at 400°C for 64 hrs. and quenched in water (15°C). Then they were tempered at 100°C, 150°C and 200°C for 2 hrs. From the corrosion experiments it is concluded that the heat treated Electron alloys are more corrosion-resistant than the cast. Zn, which inhibits corrosion, is a desirable alloying constituent. HN (13)

Structural Precautions to Lessen Corrosion of Chemical Equipment (Bauliche Massnahmen zur Korrosionsverhütung an chemischen Apparaten). PAUL SCHAFMEISTER & HERMAN BRAUN (Krupp) *Chem. Fabrik*, Vol. 10, Jan. 6, 1937, pp. 9-13; **Structural Means for Preventing Corrosion.** *Ibid., Chem & Met Eng.*, Vol. 44, Aug. 1937, p. 417. Review of fundamentals of apparatus design to reduce corrosion losses. Galvanic action resulting from contact between dissimilar metals in a suitable electrolyte and contact between metals and non-conductors are not always sufficiently considered in design. Service may fail to duplicate laboratory tests, owing to changes in concentration of corroding medium and in composition of apparatus parts, or variations in temperature. Cold working of equipment members during their construction often induces stresses deleterious to the corrosion resistance of the metal. Several examples are given. 14 references. FPP + PRK (13)

The Prevention of Failures of Surface-condenser Tubes. R. E. DILLON, G. C. EATON & H. PETERS. *Trans. Am. Soc. Mech. Engrs.*, Vol. 59, Apr. 1937, pp. 147-150. Original research. New investigations into the causes of cavitation in condenser tubes proved that cavitation is due to the formation of vortices in the inlet water box and starts when the water pressure at a point approaches the pressure corresponding to the water temperature and the cavities in the water are filled with vapor. The complex conditions are discussed and means for preventing the formation of vortices and the consequent destruction of the condenser tube metal were developed. Ha (13)

The Model Basin High Speed Camera for Propeller Research. E. L. GAYHART. *J. Am. Soc. Naval Engrs.*, Vol. 49, May 1937, pp. 174-183. Discussion and description with photos is given for camera used in studying cavitation of propellors. The use of Hg arc stroboscope was found to be necessary to obtain individual exposures instead of composite pictures. For model, propellor 8 in. diam. (average) cavitates when rotating about 1400 r. p. m. equivalent to 350 r. p. m. on destroyer. Details of the successful methods are discussed and some of the individual shots are reproduced as obtained on motion picture film. WB (13)

The Corrosion of Various Constructional Steels. Part IV. *Welder*, Vol. 9, Mar. 1937, pp. 89-91. Adding Ni to weld metal was found to increase corrosion resistance of weld deposit in saline solution. Tests made with salt spray are incomplete and will therefore be reported at later date by the authors. Graph of weight loss for various welds in alternate immersion test in sea water is shown and sketch given for method of making tests for solution potentials of weld metal versus parent metal. WB (13)

Effect of Cupric Sulphate and Nitrate on Pure Copper (Action du Sulfate et du Nitrate Cuivriques sur le Cuivre Pur). GEORGES GENESLAY. *Bull Soc. Chim.*, Vol. 4, Jan. 1937, pp. 111-114. Original research. The initial reaction is the formation of Cu_2O. After several days, this is followed by the formation of basic sulphate $3CuO.SO_3.2H_2O$ in the presence of O_2. In CO_2 the reaction stops at Cu_2O and no malachite or other basic carbonates are formed. Normal solutions of Cu $(NO_3)_2$ in contact with Cu plates show the same reactions, i.e. the formation of Cu_2O and the formation of basic nitrate, $Cu(NO_3)_2.3Cu(OH)_2$ in O_2. **The Corrosion of Metallic Copper by Solutions of Magnesium Chloride in Moist Air and in Carbon Dioxide (Sur la Corrosion du Cuivre Métallique par les Solutions de Chlorure de Magnésium à l'Air Humide et en Atmosphère de CO_2).** Ibid., pp. 117-120. Original research. K and Na nitrates and Na_2SO_4 in contact with pure Cu form Cu_2O. In an atmosphere of CO_2, sea-water chlorides form malachite. $NgCl_2$ is the most active agent. Atacamite or $3CuO.CuCl_2.3\ H_2O$ is obtained in moist air by exposing Cu to a 2 *N* solution of $MgCl_2$. Below 1*N* $MgCl_2$, Cu is covered with Cu_2O only. The most effective concentration is lowered to .4 *N* if CO_2 is present. Applying more diluted $MgCl_2$ solutions, an outer layer of green basic carbonate and an intermediate layer of Cu_2O was observed. Analogous, though less conspicuous results were obtained with NaCl. Chlorides attacking Cu form atacamite in air and malachite in CO_2. Assumes that CO_2 acts as a buffer decreasing the pH value of $MgCl_2$ solution. **Corrosive Action of Alkaline Carbonates and of Ammonium Carbonate on Copper (Action Corrosive des Carbonates Alcalins et du Carbonate d'Ammonium sur le Cuivre).** Ibid., pp. 120-122. Original research. It is shown that neutral or acid alkali carbonates and ammonium carbonate form malachite on Cu. The effectiveness of the various reagents in relation to their concentration was studied. A dark green carbonate of unknown composition was obtained when vapors of $(NH_4)_2CO_3$ free of water formed carboxydiamine as an intermediate product which decomposes and ends up as malachite. **Can Molds Modify the Effect of Copper Sulphate on Copper (Les Moisisures Peuvent-elles Modifier l'Action du Sulfate de Cuivre sur le Cuivre?).** Ibid., pp. 123-125. Original research. Furnishes the proof that Dubois' hypothesis assuming a biological origin of malachite cannot be upheld. **Identification of Certain Constituents in Corrosion Patinas of Copper by X-Rays (Identification par la Méthode de Debye et Scherrer de Quelques Constituants des Patines de Corrosion du Cuivre).** MARCEL GUILLOT & GEORGES GENESLAY. Ibid., pp. 125-129. Original research. X-ray analysis rather than microscopic and chemical analyses should be used for identification of patinas. The color effects of Cu_2O in conjunction with malachite, accentuated by the interfering effect of film thickness, reflection from and adherence to the metallic carrier, may be greatly misleading. Patinas may thus vary materially in color from that of their constituents. EF (13)

Rubber as Corrosion Protection (Gummi als Korrosionschutz). ST. RAINER. *Tech. Zentralbl. prakt. Metallbearbeit.*, Vol. 46, Dec. 1936, pp. 869-871. Review. Hard rubber has been used for corrosion protection of metallic parts for over 30 years. Recently soft rubber ("leather-hard rubber") has been introduced for the same purposes. Explains the difference between both kinds of rubber and utilization of the latter. EF (13)

Industrial Equipment Protected by Specially Formulated Synthetics. *Steel*, Vol. 100, May 24, 1937, p. 56, 58, 82. Gives examples of the use of phenolic resin coatings for the protection of steel tainter gates and food and beverage equipment against abrasion and corrosion. MS (13)

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Scale Loss of Steel in Rolling Mills. SABUO UMINO (Japan Steel Mills Co.). *Tetsu-to-Hagane*, Vol. 23, Mar. 25, 1937, pp. 288-289. In Japanese. Review plus original research. An aid to the determination of scale-loss in steel is given by a formula that is a function of time of heating, heating temperature, surface area, volume of steel piece under heat-treatment, kind of material, amount of excess air, kind of fuel, and time in which the steel is in contact with the atmosphere. NS (13)

Maintaining Cooling Installation (Zerstorungsverhütung in Kühler-Anlagen). F. WEHRMANN. *Gas-u. Wasserfach*, Vol. 80, Jan. 9, 1937, pp. 24-26. Practical. Condenser and cooler tubes carrying city water were investigated as to the cause of their corrosion. CO_2 and O_2 were found to be the strongest attacking elements; the removal of the former is not sufficient, for if O_2 be present a protective layer must be formed to suppress destruction. Several means for protection, as deacidifying by addition of lime, irradiation of the water, electrolytic methods, painting with a water-resisting lacquer, are discussed. None has given absolute satisfaction. 8 references. Ha (13)

Discussion of the Report by Sir Robert Hadfield and S. A. Main, on the Corrosion of Iron and Steel (Contribution a la Discussion du rapport de Sir Robert Hadfield et S. A. Main sur la Corrosion du Fer et de l'Acier). A. PORTEVIN & E. HERZOG. *Métaux et Corrosion*, Vol. 12, Jan. 1937, pp. 9-15. Original research. The report of Sir Robert Hadfield (See *Metals and Alloys*, Vol. 8, Feb. 1937, p. MA106L/3) covers chiefly the corrosion of steels due to marine agents. Because a similar study was made at Acieries de Pompey, the following report is presented as a further contribution to the corrosion problem: (1) *Speed of Corrosive Attack:* Laboratory tests indicate that the alternating immersion method is more rapid than the total immersion in still or agitated solution. (2) *Type of Attack:* Open-hearth or Bessemer steels showed practically uniform attack. (3) *Condition of the Surface—Effects of the Scale:* Samples covered with scale corroded 20-30% less than the polished samples. The difference in potential of Fe_3O_4—Fe in salt water is 1 volt at 0.002 amperes per cm^2. Magnetite can play the role of cathode and it is formed by the reaction between the yellow rust ($Fe_2O_3.H_2O$) and the ferrous hydrate (FeO, H_2O), its resistivity in wet state being 3-4 ohms/mm.; $Fe_3O_4.H_2O$ is therefore a semiconductor. The rust $Fe_2O_3.H_2O$ is an insulant, but it facilitates the oxidation of H at the cathodes, acting therefore as a depolarizer. (4) *Influence of Temperature:* The temperature coefficient between 20 and 40° C, for an O.H. steel in sea water is: (a) 0.20 to 0.30 in immersion tests (still solution) (b) 2.0 in alternating tests. (5) *Influence of the composition of the steels:* (a) Ni Steels: Laboratory tests at Pompey gave the following results:

Steel	Loss in Weight (Relative) Alternating	Salt Spray
Acid O.H. Steel	100	100
2.3% Ni, 0.08% C	50–65	75–70
5.6% Ni	50	65–70
33.5% Ni, 0.17% C	4.4	3

(b) Cu Steels: In salty air the addition of 0.5 to 2% Cu to steel gives better results than in the salt water immersion test. With 0.2 to 0.3% Cu steel no improvement in corrosion resistance was noticed. In sulphurous atmosphere 0.3-0.4% Cu steel is more resistant to attack. In the corrosive atmosphere, near the blast furnaces at Pompey, a steel containing 0.5% Cu, 0.5% Cr is about 25-35% more resistant to corrosion. (c) Cr Steels: The following results show the relative corrosion of Cr Steels:

Steel	Salt Spray 3½ mos.	Alternating Immersion Tests 2½ mos.	Depth of Pitting
1% Cr Steel	85	85–80	
2% Cr Steel	74–70	50–55	
3% Cr Steel	60–65	45–50	0.05–0.1 mm.
4.5% Cr Steel	50–45	32–35	0.3 –0.4 mm.
13% Cr Steel	1.9	2.3	0.2 –0.3 mm.
18/8 Cr/Ni	0.3	0	
Standard Steel	100.0	100	

(d) Ordinary Steels: According to the authors' results the composition of the ferrous materials are secondary to the composition of the sea water and its temperature. Other important factors which affect corrosion are: the mixing of solution and the speed of air. Stirring of solution increases the corrosion, at 30°C., as follows: 168 gm./m^2 in 30 days with a stirring of 20 revolutions per minute, 240 with 60 rpm., and 60-70 without agitation, for the same length of time. The resistivity of the product of corrosion is: dry rust 200,000 ohms per cm., and moist rust only 1000 ohms per cm. FeS and FeP (26.1% P) give a current of 0.12-0.16 amps./cm^2 in sulphuric acid, whereas in 1 *N*, KCl solution only 0.001 to 0.004 amps/cm^2 pass. (e) Effect of other additional elements: Beneficial effects are obtained with 3 to 12% Al and with (2 + 1%) Cr + Si in steel. 15 references. GTM (13)

14. APPLICATION OF METALS AND ALLOYS

Strength and Cost of Alloy and Carbon Steel Tubes. W. L. NELSON (Staff) *Oil & Gas J.*, Vol. 36, June 3, 1937, pp. 97-98, 108. Reasons for adopting alloy steel tubes in the oil industry are: superior high-temperature strength, superior corrosion resistance and small bends that may be used with smaller diam. tubes. Equations and curves are worked out, based on strength and cost to determine when an alloy steel can be used economically compared with a C steel. **Evaluating Alloy Steel Tubes for Cracking Still Service.** *Ibid.*, June 24, 1937, pp. 79-81. Data assembled from 11 references show relative scaling tendency, cost and strength of tubing steels and relative life and cost of maintaining tubes. VVK (14)

Wire Ropes for Mines. M. A. HOGAN. *Bull. Inst. Mining Met.*, No. 391, Apr. 1937, 35 pp.; No. 392, May 1937, pp. 15-21; No. 393, June 1937, pp. 1-4. Wear, corrosion, and fatigue (bending and tension) of wire ropes as used in mines are discussed. The manufacture and properties of various types of wire ropes are described. AHE (14)

Bearings for Special Services. JOHN E. HYLER. *Mill & Factory*, Vol. 20, Jan. 1937, pp. 83-86, 108. Practical. Properties required of a bearing include mechanical strength, favorable bonding characteristics, high melting point, fatigue resistance, antifriction and non-scoring characteristics, conformability and corrosion resistance. Pb bronzes are favored for poorly lubricated applications, steel-backed bronze for automotive connecting rods. Graphite, molded bearings and oil-absorptive bearings are also discussed. FPP (14)

14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

Light Metal Bearings (Leichtmetall-Lager) R. HIZMANN (Deutsche Lufthanse, Staaken) *Metallwirtschaft*, Vol. 16, May 14, 1937, pp. 477-481. Practical. This article gives a series of examples of Al- and Mg-base bearing alloys and the fields in which they may be used. Mg alloy bearings have proved satisfactory in installations where they are not required to withstand high loads. For higher stressed bearings with hotter running temperatures several Al alloys exhibit good bearing properties. The variety of alloys used shows that there is no preferred composition. A heterogeneous structure seems to be more important for a useful bearing alloy than a specific composition. GA (14a)

Cadmium-silver-copper Bearing Alloys. C. F. SMART (Pontiac Motor Co.) *Metal Ind., London*, Vol. 51, July 16, 1937, pp. 61-64. Original research. These alloys showed better life in test than babbitt bearings. Alloys of Cd with other metals gave adverse results. Although this alloy does not bond well to steel, a bonding alloy of Cd-Zn, Cd-Ni, or Cd-Zn-Ni gave good results. Bearings of this type have two objections: (1) the cost of the Cd, and (2) the susceptibility of the alloys to corrosive attack by organic acids in lubricants. 8 references. RWB (14a)

The Use of Nickel in Non-ferrous Alloy Castings. J. O. HITCHCOCK (Mond Nickel Co.) *Metal Ind., London*, Vol. 50, June 11, 1937, pp. 659-664; June 25, 1937, pp. 711-713. General review. In bronzes Ni narrows the α phase, and helps in Pb distribution. The bronze is made denser and the grain size is reduced. Claims are made for better plate adhesion. Ni improves ductility of high tensile brass, the properties of zinc base alloys, and acts as a hardener for Sn, Pb and Cd. Heat treatment of Al alloys containing Ni is discussed. Ni alloyed with Cu cuts down uneven wear in slip rings. Cu is hardened and its corrosion resistance improved. Ni base alloys are treated briefly. 4 references. RWB (14a)

Electrical Conductivity of Aluminum Used in Overhead Lines (Ueber die elektrische Leitfähigkeit von Aluminium für Freileitungen. ALFRED SCHULZE (Phys. Tech. Reichsanstalt) *Physik Z.*, Vol. 38, June 15, 1937, pp. 445-446. Original research. Reports on tests made on 71 wire samples (2-3 mm. diam.) from 7 German producers with the object of determining whether the specifications of the I.E.C. are met, i.e. minimum strength of 20,000 lbs./in.^{2} and specific electrical resistance less than 0.02828 ohms mm.^{2}/m. at 20° C. EF (14a)

Street Vehicles of Light Metal—a Pertinent Consideration (Strassenfahrzeuge aus Leichtmetall—eine zeitgemässe Betrachtung) H. BRAUER. *Aluminium*, Vol. 19, May 1937, pp. 306-312; *Automobiltech. Z.*, Vol. 40, Sept. 10, 1937, pp. 425-430. General discussion. Limit to which the saving of material in vehicle construction can be carried without impairing the riding qualities and comfort of passengers in a car, and comparative merits of welding and riveting, are discussed. Ha (14a)

Non-ferrous Metals in Aircraft Construction. *Metal Ind., London*, Vol. 51, July 2, 1937, pp. 3-4. General description of the British aircraft construction display at Hatfield. RWB (14a)

Inserts in Die Castings Widen Field of Application. *Machine Design*, Vol. 9, Mar. 1937, pp. 36-39. Practical. Specific applications are described showing the advantages of making inserts by die-castings such as roller-bearing races, automobile steering wheel hubs, gear housings, bushings, vending machines, electrical conductor and heater wires, magnets, field frames for small motors, centrifugal pump impellers, etc. EF (14a)

The Manufacture of Nickel Coinage. TSUGUO HIROSE (Osaka Imperial Mint) *Tetsu-to-Hagane*, Vol. 23, Apr. 25, 1937, pp. 360-362. In Japanese. Descriptive. An outline of the manufacture of Japanese nickel coinage is given. NS (14a)

Flexible Joints for Aluminum Bus Bars (Biegsame Verbinder für Aluminium-Leitungsschienen) R. SCHULZE. *Aluminium*, Vol. 19, May 1937, pp. 337-338. Descriptive. Expansion joints of Al are made of strips 0.3-1.0 mm. thick and 10-100 mm. wide; the ends are cast in solid blocks which are bolted to the bus bars. Casting method is described. Ha (14a)

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14b. Ferrous

M. GENSAMER, SECTION EDITOR

New Construction Features Minimize Steel Home Disadvantages. R. L. HARTFORD (Staff). *Steel,* Vol. 100, Apr. 26, 1937, pp. 46-47, 87. Describes prefabricated all-steel home developed by H. L. Walters. Basic framework is bolted together and lighter preformed sheet-steel members are interlocked in such a way as to allow for expansion or contraction with temperature changes. No riveting or welding is required. Low-C "metal furniture" sheets are used. All metal surfaces are rustproofed. MS (14b)

Permanent Magnets II—Their Manufacture, Materials and Shapes. J. DELMONTE. *Product Eng.,* Vol. 8, May 1937, pp. 181-183. Magnetic properties of C, Cr, W, Al-Ni and Co-Ni-Ti steels are tabulated and their heat treatment briefly described. A few forms of magnets used commonly in instruments are given. Ha (14b)

Pipes and Pipe Connections for Long Distance Gas Conduits (Rohre und Rohrverbindungen für Fernheizleitungen) *Arch. Wärmewirt.,* Vol. 18, May 1937, p. 134. Review. Standards for pipes for long distance gas conduits are given. JZB (14b)

Cutting Tools for Garden, Field and Forest (Schneidwaren für Garten, Feld und Forst) H. AUELMANN. *Die Klinge,* Vol. 4, Mar. 1937, pp. 97-104. Review of the special types of cutting tools used by the gardener, farmer and hunter. JZB (14b)

Experiences of the Trade in the Sale of Agricultural Articles (Erfahrungen des Fachhändlers beim Verkauf landwirtschaftlicher Artikel) H. DÄUMER. *Die Klinge,* Vol. 4, Mar. 1937, pp. 95-96. Description of steel articles that farmers buy. JZB (14b)

All Steel Houses Are Built Complete in Shop and Moved to Building Site. *Steel,* Vol. 100, June 28, 1937, pp. 44-45. Describes residences built by R. G. LeTourneau Inc., Peoria, Ill. Cu-bearing steel is used throughout and all joints are welded electrically. MS (14b)

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

of METALS & ALLOYS, published monthly at East Stroudsburg, Pa., for October 1, 1937.

State of New York)
County of New York) ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Philip H. Hubbard, who, having been duly sworn according to law, deposes and says that he is the Business Manager of METALS & ALLOYS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

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(signed) PHILIP H. HUBBARD.
Business Manager.

Sworn to and subscribed before me this 6th day of October, 1937
CURVILLE C. ROBINSON.
Notary Public.

[SEAL] (My commission expires March 30, 1938.)

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15. GENERAL

The Pacajake Selenium Deposits in Bolivia (Das Selenvorkommen von Pacajake in Bolivien) HANS BLOCK. *Metall u. Erz,* Vol. 34, No. 10, 1937, pp. 237-238. History, geology, current mining facilities and composition of Se-containing ores in Bolivia are discussed. FPP (15)

Restrictions Bring Improved Materials. HANSHEINRICH PONTANI (Metallgesellschaft) *Metal Ind., London,* Vol. 50, June 11, 1937, pp. 621-624. General review of the research work being conducted as a result of Germany's withdrawal as an importer of Cu and Cu alloys. RWB (15)

German Metal Working Practice. *Metal Ind., London,* Vol. 51, July 30, 1937, pp. 115-116. General. RWB (15)

Trends in German Practice. J. SELWYN CASWELL. *Blast Furnace Steel Plant,* Vol. 25, June 1937, pp. 636, 648. Gives author's impressions, formed during recent visit to Germany, of present day German steel mill practice. MS (15)

The National Bureau of Standards. LYMAN J. BRIGGS (Bur. Standards) *J. Applied Phy.,* Vol. 8, May 1937, pp. 298-306. Outline of the purpose, organization, facilities and work of the Bur. Standards, including notes on its history and growth. HFK (15)

The Indexing and Filing of Technical Literature. H. N. BASSET. *Chemistry & Industry,* Vol. 56, May 15, 1937, pp. 463-465. Discusses the Universal decimal library classification method. AAA (15)

A Modern Foundry. *Wild-Barfield Heat-Treatment J.,* Vol. 2, June 1937, pp. 60-63. Descriptive of foundry of British Northrop Loom Co., which features efficiency, cleanliness, healthful working conditions. FPP (15)

Heat Treatment Furnaces and Auxiliaries. *Electrical Rev.,* Vol. 120, Apr. 23, 1937, p. 619-620. Describes several installations of electric heat treating furnaces; equipment for shearing and straightening rolled products, cleaning of castings, grinding, and welding; and electric steel-works motors. MS (15)

An Aero-engine Works Installation. *Electrical Rev.,* Vol. 120, June 11, 1937, pp. 879-881. Describes electrical applications in the works of Alvis, Ltd., Coventry, England, with much attention to heat-treating furnaces. Includes brief mention of Ni-plating equipment. MS (15)

15a. Economic

Fatal Accident on a Potassium Cyanide Hardening Furnace (Tötlicher Unfall an einem Zyankalien-Härteofen) KACHEL. *Oberflächentech.,* Vol. 14, July 20, 1937, pp. 144-145. Traces of moisture left on nuts and bolts being immersed in the bath caused the latter suddenly to rise and splash fatally burning the face and body of the workman. Ha (15a)

Radium, Uranium, and Vanadium Industries in 1936—Advance Summary. ROBERT H. RIDGWAY & H. W. DAVIS. *U. S. Bur. Mines, Mineral Market Repts.* No. M. M. S. 563, June 22, 1937, 1 p. Statistical. AHE (15a)

Consumption of Ferrous Scrap and Pig Iron in the United States—1936. ROBERT H. RIDGWAY, H. W. DAVIS & M. E. TROUGHT. *U. S. Bur. Mines, Mineral Market Repts.* No. M. M. S. 550, May 28, 1937, 4 pp. Statistical. AHE (15a)

Geological Congress at Moscow; Russia's Mineral Production. V. S. SWAMINATHAN. *Times Trade and Eng.,* Vol. 41, July 1937, p. 8. Includes statistics on production of principal metals during 1936. MS (15a)

Mechanisation. M. L. YATES. *Mech. World Eng. Record,* Vol. 101, May 21, 1937, pp. 509-511, p. 524. Practical. Mechanization is defined as change in methods or equipment tending to lessen reliance on the unaided mental and manual endowment of the worker. Labor-saving modification in (British) foundry and forging operations are discussed. EF (15a)

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Replies to box numbers should be addressed care of METALS AND ALLOYS, *330 West 42nd Street, New York*

POSITION WANTED: Physical chemist and metallurgist desires change. Ph.D. in physical chemistry and physical metallurgy. Four years of industrial experience. Six years' experience teaching metallurgy in engineering schools. Will consider either industrial or teaching position. Box MA-49.

SMELTING AND REFINING PLANT: Graduate chemist desires to purchase outright or an interest in a smelting and refining plant, preferably in or near New York City. Box MA-53.

PATENT ATTORNEY—Member of New York Bar—licensed professional engineer—12 years with two organizations as chemist, chemical engineer and patent attorney—experienced in all phases of patent practice. At present employed. Desires new connection with firm or corporation. Box MA-54.

SALES REPRESENTATIVE by leading manufacturer of fire clay, moulding sand, foundry material and refractories. University man with foundry and technical background preferred. 35 to 40 years old. Good salary. Permanent position. Box MA-55.

WANTED: Two salesmen to handle our Alloy Steel Bars, one for Texas and Oklahoma oil fields; one for Ohio, Indiana, and North Central States. Box MA-56.

CHEMIST with three years of varied chemical and metallurgical experience, chiefly with stainless steels—25—single—excellent academic and industrial references—location immaterial—will consider research, production, business or teaching position. Box MA-57.

WELDING ENGINEER, supervisor, inspector. 10 years experience in welding procedure, shop methods, design, physical metallurgy. Qualification tests and training of apprentices. Available January 1, 1938. Box MA-58.

HELP WANTED—Metallurgist. Graduate, with experience to conduct laboratory and shop studies of ferrous and non-ferrous alloys and heat treating processes in large manufacturing plant located in Chicago area. Give full particulars including age, education, experience, technical publications, salary expected, and small snapshot. Box MA-59.

ANALYTICAL SPECTROSCOPIST with experience in physical metallurgy. Desires permanent industrial position that allows most of time in either or both of these fields. Ph.D. (1931) in physical chemistry. Minor in physics. Interested in research work. Ability to cooperate. Publications. Married. Box MA-60.

POSITION WANTED: Metallurgist desires change in location. Ten years professional experience in testing, development and research, in U. S. Government Laboratory. Box MA-61.

METALLURGICAL CHEMIST desires position with modern steel foundry. Technical graduate, 3 years experience in analytical and metallurgical direction and sand control. Location no object. Now employed with large mid-western electric steel foundry. Box MA-62.

Book Reviews

BEARING METALS AND ALLOYS
Henry Norman Bassett

Longmans Green & Co., New York, 1937. Cloth, 6 x 8¾ in., 428 pages. Price $8.50.

The author is chief chemist, Egyptian State Railways, but his book is not confined to railway bearings. The preface states that the book is meant for works managers and designers rather than the research worker. It is, however, chiefly made up of accounts of research work and deductions therefrom. One of its chief values is in the way it describes the conditions of the test cited so that one may more intelligently evaluate the conclusions.

The early chapters deal with the historical development of bearings, design and oil grooves, oiliness, mutual effect of oils and bearing metals and theories of proper microstructure. These assemble the available information in brief but acceptable style. The book then goes on, in spite of the preface, to a quite detailed discussion from the metallurgical and metallographic points of view, in turn of lead, copper, cadmium, etc.—base alloys, together with their properties. Fatigue is mentioned, but is not used to relieve a poor bond from all responsibility for failures. Bronzes, leaded bronzes and copper lead are then similarly discussed.

The modern alkali-hardened lead base alloys are approved as decidedly useful for low speeds and loads as in railway service. Under each general type of bearing metal the effect of impurities is considered in detail.

A great many miscellaneous topics are touched upon, including wood, rubber, condensation-resin, and porous bearings, behavior of graphite, E. P. lubricants, cadmium base alloys, etc. etc., but in most cases they are only touched. Many of the problems and topics that have recently caused active discussion in the U. S. are either omitted or handled very briefly. Thus quantity production of bearings, close limit automotive bearings, steel backs and their proper thickness, corrosion of Cd-base and Cu-Pb linings, proper structure of Cu-Pb for severe service as in aircraft engines, the question of "embed ability" and the like are not discussed beyond mere casual mention if at all. Egypt is a long way from Detroit. Were these topics as much in the author's mind as they are in the minds of American producers and users of automotive bearings he would doubtless have discussed them as intelligently as he has the topics he has covered.

We would have been interested in his appraisal of the zinc oxide containing lubricants proposed a while ago in England but failed to locate any comment. Nor could we find comments on the use of two different bearing materials at once, as in the case of piston rings with bronze inserts.

In the appendix there is a list of some 50 bearing services with suggestions for suitable alloys, but these are put forth with no degree of finality. We are left with the idea that an amazing lot of different alloys serve as bearings under different conditions, and that while there are a lot of ideas on it, nobody knows any too well why they work or fail. Nor are we given any clear idea of how the author would test a new bearing metal to evaluate its suitability for any particular service. This is partly due to the fact that the author has no ax to grind, and if he has any very definite convictions, he has preferred to submerge them and report what has been published. The arrangement and presentation of the material are facilitated by the author's connection with the practical use of bearings. It is readable and worth owning by all metallurgists interested in the production and use of bearings, even though the price does seem a bit steep. The only other book of its nature is Corse's Bearing Metals and Bearings, published in 1930. Sufficient new information has become available since then thoroughly to justify the writing of another book.—H. W. GILLETT.

SHEET METAL HANDBOOK *(Handbuch für wirtschaftliche Blechbearbeitung)*
3rd EDITION. L. Schuler A.-G.

Julius Springer Verlag, Berlin, 1937. Cloth, 4½ x 7 in., 446 pages. Price 4.50 RM.

This is a peculiar combination of handbook and catalog, prepared by a large maker of presses for deep stamping, can making machinery and the like. It carries much information in text, tables, graphs and monograms on details of deep drawing practice such as clearance between punch and die, pressure required, hold-down pressure, lubricants, annealing and pickling, and alloy steels for shears and punches. Structure and testing of deep-drawing sheet by tensile, Erichsen, hole-widening, and other methods, German specifications for steel and non-ferrous metals and alloys are next taken up.

The principles of construction of presses, exemplified by those made by Schuler, safety devices used, etc., are then discussed. From this point on, it becomes a catalog of Schuler presses, brakes, curving devices, shears, and can-making equipment. A series of gage, weight and conversion tables applicable to various alloys in sheet form follows.

There is sufficient of the true handbook type of information included to make the volume useful for reference.—H. W. GILLETT.

METAL COLORING *(Metallfärbung)*
2nd Edition
Hugo Krause

Julius Springer Verlag, Berlin, 1937. Paper, 6¼ x 9¼ in., 183 pages. Price 7.50 RM.

This edition of Krause's book is really a new treatise and not a revision of that of 1922. According to the preface, most of the methods have been tested by the author so that the volume apparently is not just a compilation. Although it fully lives up to its subtitle ("The most important methods for coloring and protecting the surface of metal products"), very little discussion is included of the fundamental side of metal coloring.

The greater portion, 125 pages, of the text is devoted to a chapter on methods for the chemical coloring of Cu, Fe, Ag, Au, Pt, Zn, Cd, Sn, Pb, Ni, Al, Mg, and their alloys. Shorter chapters describe cleaning and pickling, preparation of electroplates both with and without an external source of current, preparation of anodic and cathodic films, and mechanical coloring. Of special interest are the sections on copper patinas, phosphate coatings on iron, steel, and zinc, and anodic films on iron, aluminum, and copper.

The book as a whole presents a large amount of material in a clear, compact style. In a few cases the descriptions of processes are apparently incomplete; i.e., in an electrolytic process the cell voltage only is given. A few errors in the text are also evident. For example, on page 133 the author states that the normal "free acid" content of a certain manganese phosphate rust-proofing bath is 2.5 to 3.0%. A check with the original reference showed that what was meant was the "total phosphate" content. The bibliography is fair. However, many processes are referred to by the surname of the inventor only with no dates or journal references. Patents are given by number only, and only German patents are quoted. Nevertheless the field of metal coloration, in which few treatises exist, is fairly well covered up to and including 1936. —IVER IGELSRUD.

THE INGOT PHASE OF STEEL PRODUCTION
Emil Gathmann

Gathmann Engineering Co., Baltimore, 1937. Cardboard, 7 x 10¼ in., 76 pages.

This little book sets forth clearly the requirements of and reasons for the design of big-end-up ingots. Emphasis is placed on the necessity for soundness and relative homogeneity in the ingot, and the author's claims for the superiority of big-end-up over other designs are illustrated with many photographs of split ingots of all types showing the location and amounts of blowholes and shrinkage cavities. In addition to the discussion of ingot design, there are very brief sections on mold washes, ladle practice, reheating practice and rolling practice. The booklet of course has an advertising purpose, but is written in a sufficiently restrained fashion so that it carries a good deal of conviction.—H. W. GILLETT.

Current News

Ryerson's New Certified Steel Plan

Joseph T. Ryerson & Son, Inc., Chicago, have announced a new unique plan that will aid steel users to secure more uniformly satisfactory results. The system to be known as the "Ryerson Certified Steel Plan," undertakes to select whole heats of steel that have particularly desirable qualities, make thorough tests and give the user a report on the analysis, tests, etc. The Ryerson company has been working on the plan for several years, adjusting stocks and ironing out operating problems. The plan naturally is of particular value on the alloy steels that usually require heat treatment before use.

The Ryerson Certified Steel Plan solves many of the problems that have developed during the rapidly increasing use of alloys. Under this plan, Ryerson selects entire heats of alloy steels that come within certain narrow analysis limits. The steel is tested for chemical and heat treatment characteristics and complete data is prepared for delivery to every customer buying the steel, whether only a few bars or several tons.

The Society of Automotive Engineers has compiled a set of specifications covering the great majority of alloy steels used today. In compiling these specifications, they have worked with the steel producers and have narrowed the limits of composition as far as it is practical for the steel makers to follow. These limits are relatively wide and, therefore, steel specified only to the S.A.E. specifications may vary greatly in heat treatment response from one heat to another. This variation frequently results in ununiform results and the extra expense of re-treatment.

Ryerson has been seeking to solve this commonly recognized problem for many years. To accomplish the desired result, Ryerson had two fundamental problems to overcome. The first was to secure standard alloy steels for stock which conformed to an analysis range closer than that specified in the S.A.E. ranges, and which were closely controlled in general hardening characteristics such as inherent grain size, etc. The second problem, after having secured such steel, was to develop a method of informing each customer of the complete analysis and heat treatment characteristics of each bar shipped to him.

Ryerson naturally could not offer this plan to industry until they had accumulated sufficient stocks of these accurately controlled steels to be able to give prompt shipment on practically any size and analysis which is demanded, and of course, the accumulation of such stock was quite a problem. During the several years of preparation necessary to such a plan, the Ryerson company has carefully tested the method by working closely with selected companies and checking results. Through the cooperation of these companies the plan has been thoroughly studied and it has been proved that it results in much more economical heat treatment for several good reasons. To summarize the whole scheme of Ryerson Certified Alloy Steel, we find the following outstanding points:

1. There is available from warehouse stock, alloy steel which has been selected to meet specifications much closer than the standard S.A.E. ranges and is accurately controlled in regard to grain size and other hardening characteristics.
2. All bars except very small diameters are identified by letter symbols stamped on the ends of the bars for purposes of positive identification. Small bars are tagged.
3. All bars have been metallurgically tested and the results of these tests, which cover both chemical analysis and heat treatment response, are tabulated and transferred to similarly identified data sheets.
4. When a shipment is made to a user, a data sheet for the bars shipped is put in his hands in sufficient time so that it can be transferred to the heat treating department before that department is called upon to subject the steel to heat treatment.
5. The plan as outlined simplifies the heat treating department's problem because they know exactly what material they have to work with, and also have been informed ahead of time as to how it will respond to heat treatment. The purchasing department's problem is made easier because it will not receive reports from the heat treating department to the effect that the steel was either more or less responsive than previous lots. The production department is helped because they are not delayed by the heat treating department, as they often are in the case of steel which does not respond properly to the first attempt, and therefore, had to be treated a second time.

The Ryerson Company has prepared a booklet describing the plan and its advantages in detail.

Personals

● John Howe Hall, one of the leading metallurgists in steel foundry practice and a specialist in other fields, has resigned as technical assistant to the president of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J. He will practice as a consulting metallurgical engineer, specializing in steel foundry work as well as in the manufacture of special steels and irons to resist severe wear and corrosion. He has recently been elected chairman of the steel foundry division of the American Foundrymen's Association for next year. His present address is Box 537, High Bridge, N. J.

● Dr. Frederick M. Becket, president of the Union Carbide and Carbon Research Laboratories, New York, and one of the leading metallurgists of the country, was presented with the Edward Goodrich Acheson Medal and $1000 Prize at the annual fall meeting of The Electrochemical Society in St. Louis in October.

● Dr. John Chipman has been appointed professor of metallurgy at the Massachusetts Institute of Technology. He is a distinguished authority on steel making, particularly the chemical reactions which occur in liquid steel and open-hearth slag. Dr. Chipman comes to the Institute from the American Rolling Mill Co., where he was associate director of research from 1934 until he accepted his new appointment.

● Dr. Edward Bausch, chairman of the board of the Bausch & Lomb Optical Co., Rochester, N. Y., was recently honored by the parent chapter of the Sigma Xi Scientific Society at Cornell with alumni membership, a signal honor. Dr. Bausch, now in his 83rd year, is widely known for his inventions and contributions to the optical industry.

● The Samuel Wylie Miller Medal, an annual award of the American Welding Society presented for meritorious contributions to the science and art of welding, has been awarded to H. Sidney Smith. Well-known in the acetylene industry both in America and abroad, Mr. Smith has served as president of both the British Acetylene Association and the International Acetylene Association and has been directly responsible for many important developments in acetylene utilization.

● H. N. Davis, president of the Stevens Institute of Technology, Hoboken, N. J., has been elected president of the American Society of Mechanical Engineers for 1938. He will assume his duties on Dec. 10, 1937.

● Withold W. Kosicki, after being associated with J. T. Wing & Co., Detroit, for 17 years, has taken over the foundry of that company to operate it as the Metalloy Products Co.

● H. McE. Patton has joined the staff of the research and development division of the Jones & Laughlin Steel Corp., Pittsburgh. He was formerly with the Pittsburgh Steel Co.

● Gustav Laub, general manager of sales, Vanadium Corp. of America, New York, has recently been appointed assistant vice president and general manager of sales.

● Ralph L. Wilson, formerly metallurgical engineer of the Timken Steel & Tube Division of the Timken Roller Bearing Co., Canton, Ohio, has become associated with the Climax Molybdenum Co. in the capacity of metallurgical engineer in its development field.

Manufacturers' Literature

Industrial Heating Equipment

Bulletin No. 3 discusses oven and pot type furnaces, designed for gas or oil burning, and auxiliary equipment such as pyrometers, blowers, burners, and quenching systems furnished by the M. K. Epstein Co., Springfield, Mass. (B 1568)

Indicating Pyrometers

Wheelco super sensitive High Resistance Indicating Pyrometer, other large and small (some portable) indicating pyrometers, and switches are described in Bulletin No. 503. Wheelco Instrument Co., Chicago, Ill. (B 1569)

Flux by Induction

In the Ferrolene Gas Flux Process for gas welding the liquid flux is inducted, under pressure, directly into the gas line. Advantages claimed are use of uniform, minimum amount of flux and small amount of fumes and residue. Automatic Gas Flux Co., Cleveland, O. (B 1570)

Welding Electrodes

This 56-page catalog discusses welding electrodes, procedures for pressure vessels, the metallurgy of welding and the application of the shielded arc process, and includes useful tables and data. Champion Rivet Co., Cleveland, O. (B 1571)

Modern Metal Finishing

This bulletin, issued periodically, conducts a Questions and Answers department for metal treaters. R. & H. Chemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (B 1572)

Drop Forging Topics

The publication bearing this title is issued regularly, and contains descriptive articles on production and applications of large and small drop forgings. Drop Forging Assoc., Cleveland, O. (B 1573)

Carbide Tools, Bits and Tips

New Firthite Folder shows standard and non-standard tip designs and tools, in actual size, and includes recommended symbols for specifying angles, rakes, clearances, etc. Firth-Sterling Steel Co., McKeesport, Pa. (B 1574)

PDM Box Furnaces

Bulletin B-1036 describes and illustrates these furnaces, which may be gas or oil fired and provide temperatures up to 1800 deg. F. Metallurgical applications are listed. Philadelphia Drying Machinery Co., Philadelphia, Pa. (B 1575)

Hardening and Tempering Furnaces

Broadside "T" presents (for the first time in one publication) descriptions of Vapocarb Hump equipment for hardening and Homo equipment for tempering, annealing, etc. Leeds & Northrup Co., Philadelphia, Pa. (B 1576)

Potentiometer Pyrometers

New catalog (No. 1102) covers the complete line of Brown potentiometer pyrometers—indicating, recording and controlling, and includes the new Electr-o-Line controllers and the Brown proportioning control system. The Brown Instrument Co., Philadelphia, Pa. (B 1577)

Ampco Metal

Engineering Data Sheet No. 45 gives brief descriptions of the use of Ampco Metal steam jets for pickling tanks, chain slings and baskets, and other corrosion-resisting applications. Ampco Metal, Inc., Milwaukee, Wis. (B 1578)

Valves

Complete new catalog includes revisions and additions to air control line and a section on the new line of hydraulic valves for high working pressures. Complete engineering data and useful tables are included. C. B. Hunt and Son's Co., Salem, O. (B 1579)

Carbottom Furnaces

Actual operating data, and illustrated description are presented of SC Carbottom furnaces for general heat treating purposes. Advantages claimed are capacity and flexibility. Surface Combustion Corp., Toledo, O. (B 1580)

Zinc Plating

Zin-O-Lyte, a process for bright zinc plating producing brilliant deposits direct from the bath without bright dipping, is the subject of a new bulletin of the Grasselli Chemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (B 1581)

Furnace Control Instruments

New Bulletin (No. 462) describes temperature recorders and controllers for furnaces, kilns and industrial ovens. The Bristol Co., Waterbury, Conn. (B 1582)

Steel and Its Manufacture

The story of the manufacture of steel products by this company is given pictorially and descriptively in a 115-page handbook entitled "What We Make and How We Make It." Youngstown Sheet & Tube Co., Youngstown, O. (B 1583)

Aluminum Paint

This 100-page well indexed manual serves as a guide for the selection of aluminum paint and gives methods of mixing and applying. Aluminum Company of America, Pittsburgh, Pa. (B 1584)

Stainless Steel Gate Valves

Diagrams and specifications are included in a leaflet devoted to this company's valves which are claimed to be of simple and compact construction. The Cooper Alloy Foundry Co., Elizabeth, N. J. (B 1585)

Purifying Molten Iron

An iron finishing compound used in the pouring ladle for improving the castings is described in a pamphlet of The Maluminum Co., Indianapolis, Ind. (B 1586)

Insulation

A new catalog containing information on this company's insulations for industrial heated and refrigerated equipment also features specific insulation recommendations for various types of industrial equipment. Johns-Manville, New York, N. Y. (B 1587)

Lathes

A profusely illustrated catalog presents the features of the LeBlond lathes. Speed, power, stamina and tenacity are claimed for these lathes and accessories. Those who remember their nursery rhymes will enjoy the novel introduction. The R. K. LeBlond Machine Tool Co., Cincinnati, O. (B 1588)

Stainless Steel and Wire Products

Properties of this company's stainless and heat resisting alloy steels, and laboratory corrosion data, are given in tables in a booklet designed to show the unlimited applications of stainless steels. Pittsburgh Steel Co., Pittsburgh, Pa. (B 1589)

Prefinished Colored Metals

Tint-Metal products (lustrous colored sheet metal or metal board) are described in this folder, which contains actual sample on bases of tin-plate, steel and zinc. American Nickeloid Co., Peru, Ill. (B 1590)

Forging Presses

Bulletin No. 300 features high-speed steam-hydraulic forging presses for working heavy forgings to the close degree of accuracy required in the heavy metal fabricating industries. Chambersburg Engineering Co., Chambersburg, Pa. (B 1591)

Mo-Max High Speed Steels

Composition, tool performance, heat treatment, operations and difficulties are discussed in a booklet devoted to Mo-Max. The Cleveland Twist Drill Co., Cleveland, Ohio. (B 1592)

Marking Pencil for Hot Metal

Permanent identification of ingots, bars, plates, etc., that must be heated above a red heat, is claimed to be possible through the use of this pencil, the marks from which are not destroyed by high temperatures. Swan Pencil Co., N. Y. (B 1593)

Gas Burner Equipment

Well illustrated 65 page catalog shows representative installations of gas burners in several fields, and describes equipment for improved utilization of manufactured gas. Ensign-Reynolds, Inc., New York, N. Y. (B 1594)

Metal Hydrides

Reprints of a series of articles by P. P. Alexander on "The Hydride Process," in METALS AND ALLOYS, are available. History, production and uses of metal hydrides are discussed. Metal Hydrides, Inc., Clifton, Mass. (B 1595)

Silicon Bronzes

Attractive catalog gives general information, forms available and abundant technical data on Herculoy, described as combining the corrosion resistance of copper with the strength of steel. Table of physical and chemical properties of many other copper alloys given. Revere Copper and Brass, Inc., New York, N. Y. (B 1596)

2900 Deg. Combustion Tubes

Refractory combustion tubes, claimed to be serviceable in laboratory furnaces up to 2900 deg. F. are described in this folder of the Burrell Technical Supply Co., Pittsburgh, Pa. (B 1597)

MANUFACTURERS' LITERATURE

Carburizing Unit

The Hevi-Duty Carburizer is an electric furnace unit using the Carbonol (carefully blended gas-producing oil) process, which is claimed to provide uniform case depth, improvement in quality, cleanliness and other advantages. Hevi Duty Electric Co., Milwaukee, Wis. (B 1598)

Low-Alloy High-Tensile Steel

Mechanical and corrosion-resisting properties and applications of Cor-Ten, a ductile low-carbon, chromium-copper-silicon-phosphorus steel, are given in this 67 page catalog. Exceptionally high yield and tensile strength are claimed. United States Steel Corp., New York, N. Y. (B 1599)

A. C. Welding Electrodes

The advantages, applications and information for ordering of three types of "non-premium" A. C. type Crucible Weld electrodes are described in this bulletin of Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. (B 1600)

Graphite in the Foundry

Graphites are used in the foundry for facings and blackings, in the making of crucibles and similar refractory products, in heat resisting black paints, etc., according to folder of George F. Pettinos, Philadelphia, Pa. (B 1601)

Metal Working and Treating Problems

The current issue (Vol. 2, No. 1) of *Research Illustrated* includes interesting articles on cutting oils, heat treatment, quenching oils, salt baths and inhibitors. E. F. Houghton & Co., Philadelphia, Pa. (B 1602)

Foundry Crucibles

The history and development, types available, and typical applications and installations of graphite crucibles for foundry practice are given, together with helpful data for foundrymen, in the catalog of Bartley Crucible and Refractories, Inc., Trenton, N. J. (B 1603)

Berwick Forging Heaters

These heaters employ the direct electric resistance method to heat the metal, and feature temperature control by photocell. Advantages claimed are speed, uniformity, absence of distortion, and economy. American Car and Foundry Co., New York, N. Y. (B 1604)

Alloy Castings

Illustrated folder shows variety of intricate castings made in "National" oxidation, corrosion and abrasion resisting alloys. National Alloy Steel Co., Blawnox, Pa. (B 1605)

Controlled Reversal of Heating Operations

Type 2700 Timers automatically function any desired group of signals, valves and dampers to accomplish the actual reversal of the furnace. Automatic Temperature Control Co., Philadelphia, Pa. (B 1606)

Magnetic Separation in the Foundry

Interesting applications of the Dings high intensity separators for magnetic removal of metals from sand, abrasive grains, etc., are described. Dings Magnetic Separator Co., Milwaukee, Wis. (B 1607)

Industrial Ovens

Catalog No. 14 is a collection of bulletins dealing with the various types of ovens manufactured by the Despatch Oven Co., Minneapolis, Minn. (B 1608)

Simplified Optical Pyrometer

Catalog No. 70 states that the PYRO optical pyrometer is a rugged instrument, simple in operation and suitable for the requirements of scientific laboratories as well as for heavy duty shop practice. The Pyrometer Instrument Co., New York, N. Y. (B 1609)

Special Atmospheres for Industrial Furnaces

An instructive booklet explaining in detail the methods and composition required in designing and manufacturing inert gases. Continental Industrial Engineers, Inc., Chicago, Ill. (B 1610)

Graphitic Steel

This steel which, it is claimed, combines the more desirable features of cast iron with the high strength of steel, is the subject of a pamphlet of the Timken Steel and Tube Co., Canton, O. (B 1611)

Career in Arc Welding

Bulletin No. 416 tells of the practical and technical instruction given by the Lincoln Welding School. The Lincoln Electric Co., Cleveland, O. (B 1612)

Hold-Heet Pyrometers

Wall type and Lance type are described and illustrated in Bulletin No. 202. Russell Electric Co., Chicago, Ill. (B 1613)

Heat and Acid Resisting Castings

Bulletin No. 21 lists the most popular analyses of Standard-Alloy together with safe workable loads at different temperatures. The Standard Alloy Co., Cleveland, O. (B 1614)

High Frequency Electric Power Converters

High frequency electric converters for use in conjunction with numerous industrial induction heating applications are described. Lepel High Frequency Laboratories, Inc., New York, N. Y. (B 1615)

Aerocase

Booklet on this subject. Illustrations, curve charts, tables. American Cyanamid and Chemical Corp., New York, N. Y. (B 1616)

Electromet Review

This publication, whose purpose is to bring "News and Views of Alloy Steels and Irons" to the reader, contains interesting items. Electro Metallurgical Co., New York, N. Y. (B 1617)

Control of Furnace Atmosphere

Two bulletins devoted to a description of "Certain Curtain Control of Atmosphere"; and to furnaces for pre-heating and hardening high-speed steel have been issued by C. I. Hayes, Inc., Providence, R. I. (B 1618)

Improved Pot Hardening Furnaces

A leaflet devoted to these furnaces has been issued by the American Gas Furnace Co., Elizabeth, N. J. (B 1619)

Speed Case Steels

Data on the three new types of this company's "Speed Case" steel in the higher carbon ranges are offered by The Monarch Steel Co., Indianapolis, Ind. (B 1620)

Superficial Hardness Tester

Catalog Supplement RS-3 is devoted to this hardness tester, intended for tests where only very shallow penetration is possible. Wilson Mechanical Instrument Co., New York, N. Y. (B 1621)

Vapor-Spray-Vapor Detrex Degreaser

This special machine equipped with a monorail conveyor is described in literature from the Detroit Rex Products Co., Detroit, Mich. (B 1622)

Stainless Steel Castings

An attractive booklet contains useful information on the subject. Typical analyses, characteristics and suggested uses are listed, Joseph T. Ryerson & Son, Inc., Chicago, Ill. (B 1623)

Turbo-Compressor Data Book

This data Book No. 107 gives accurate information on the characteristics of turbo blowers and exhausters. The Spencer Turbine Co., Hartford, Conn. (B 1624)

Konik

Data on this steel's physical properties, corrosion resistance and working are offered by the Continental Steel Corp., Kokomo, Ind. (B 1625)

Spring Making

A handbook of modern spring engineering for users and designers of springs, containing useful data as well as illustrations, diagrams and engineering tables, has been issued by Barnes-Gibson-Raymond, Detroit, Mich. (B 1626)

Testing Machine

This machine, for tensile, transverse and compression testing (capacity 30,000 lbs.) is the subject of a leaflet of the Detroit Testing Machine Co., Detroit, Mich. (B 1627)

Adachrome

This plastic chrome cement, claimed to hold its component materials in suspension indefinitely, is described in a pamphlet. Botfield Refractories Co., Philadelphia, Pa. (B 1628)

Hy-Speed Case

It is claimed that this case has a sufficiently low melting point so that it can be used from 900 to 1100° F. on high speed tools. A. F. Holden Co., New Haven, Conn. (B 1629)

Steel in Forged Sections

Hardness conversion tables and tensile property tables are included in this catalog which also gives specific effects of alloying elements in steel. Heppenstall Co., Pittsburgh, Pa. (B 1630)

Corrosion and Heat-Resisting Steels

Enduro Types HCN, NC-3 and HC are described in a leaflet containing analyses, physical properties, instructions for working and applications. Republic Steel Corp., Massillon, O. (B 1631)

MANUFACTURERS' LITERATURE

Zinc Alloy Die Castings

This supplement of "A Visual Report of Progress" brings the progress being made in the die casting industry up to date. The New Jersey Zinc Co., New York, N. Y. (B 1632)

Thermalloy Castings

Information on Ni-Cr castings for heat and corrosion resistance which are X-ray inspected is given in a bulletin of the Electro Alloys Co., Elyria, O. (B 1633)

Testing Machines

Catalog 50, Part L, features Olsen Universal testing machines. Complete descriptions and illustrations. Tinius Olsen Testing Machine Co., Philadelphia, Pa. (B 1634)

Nitralloy and Nitricastiron

Leaflet describing three groups of Nitralloy also discusses "Nitrard" and "Nitricastiron." The Nitralloy Corp., New York, N. Y. (B 1635)

Wellman Magazine

Items of interest and humor are contained in this monthly paper published by The Wellman Bronze and Aluminum Co., Cleveland, O. (B 1636)

Heat and Corrosion Resistant Alloys Heated by Gas

Bulletin C1-A illustrates a number of complex castings made from Q-alloys which are recommended for pipe fittings, furnace parts, etc. General Alloys Co., South Boston. (B 1637)

Electric Heating Elements

A bulletin from this company is devoted to their electric heating elements and terminal accessories for industrial applications. Globar Div., Carborundum Co., Niagara Falls, N. Y. (B 1638)

The Jetal Process

Simple immersion in an aqueous bath for about 5 minutes colors all grades of common iron or steel a brilliant and uniform jet black. It is claimed it does not altar dimensions of articles and cannot chip, scale, peel or discolor. Alrose Chemical Co., Providence, R. I. (B 1639)

Repeated Stress Machines

These machines for determining the endurance limits of bar, wire and sheet metals are described in a pamphlet of G. N. Krouse, New Kensington, Pa. (B 1640)

Bimetal

A simplified version of its manufacture and the way it works is contained in this pamphlet. W. M. Chace Co., Detroit, Mich. (B 1641)

Dolomite Refractories

This interesting pamphlet presents the case of Clinkered vs. Calcined Dolomite in the basic open-hearth steel furnace. Basic-Dolomite, Inc., Cleveland, O. (B 1642)

Sulphur Determinator

An illustrated folder describes the Leco Sulphur Determinator, claimed to permit extremely accurate sulphur determinations within five minutes. Laboratory Equipment Corp., St. Joseph, Mich. (B 1643)

Insulcrete

The properties and uses of this lightweight cellular insulating refractory concrete, used for direct exposure to temperatures up to 2500 deg. F., are given. Quigley Co., Inc., New York. (B 1644)

Contour Sawing

A handbook on contour sawing is offered by the manufacturers of the DOALL Metalmaster which, it is claimed, offers heavy duty precision machining and finishing of metals up to SAE 1090. Continental Machine Specialties, Minneapolis, Minn. (B 1645)

Refractory Concrete

P. B. Sillimanite Hydrocast is described as a super-refractory useful for lining and other applications in industrial furnaces. Chas. Taylor Sons Co., Cincinnati, Ohio. (B 1646)

Measuring the Flow of Air and Gases

Flow meters for measuring the flow of air and gases of all kinds to obtain control of gas burning operations and carburizing are featured in a leaflet which contains a description and diagrams of these instruments. American Gas Furnace Co., Elizabeth, N. J. (B 1647)

Wear Tester

The Taber Abraser for measuring the wear resistance, adhesion and rub-off qualities of finishes is the subject of a well-illustrated booklet. Taber Instrument Co., North Tonawanda, N. Y. (B 1648)

Blue Book of Thermometals

Complete mechanical, thermal and electrical characteristics for all standard types of Wilco thermometals are included in this book which contains a review of properties and applications of modern thermostatic bimetals. H. A. Wilson Co., Newark, N. J. (B 1649)

Refractory

Thermal Alumina which can be used for working temperatures up to 1950 deg. C. and is suitable for the fusion of metals, alloys and alkalies while having a slow rate of reaction with concentrated alkaline solutions, fused salts or boiling concentrated sulphuric acid, according to the manufacturer, is the subject of an illustrated leaflet of The Thermal Syndicate, Ltd., New York, N. Y. (B 1650)

Testing Machines

The Southwark-Emery line of testing equipment is featured in a fully illustrated bulletin, containing charts, curves and technical data. Baldwin-Southwark Corp., Philadelphia, Pa. (B 1651)

Ground Shafting

Turned, ground and polished shafting and small diameter drawn, ground and polished bars are discussed in a leaflet illustrating the modern production methods used in manufacturing them. Bliss & Laughlin, Inc., Harvey, Ill. (B 1652)

Retorts for Gas Carburizing

Rotary and stationary retorts are discussed in a leaflet which gives different analyses which may be used for varying conditions. The Calorizing Co., Pittsburgh, Pa. (B 1653)

High Temperature Combustion Furnaces

Single and double tube laboratory furnaces, provided with Globar elements producing temperatures up to 2550 deg. F., are described in a bulletin from the Burrell Technical Supply Co., Pittsburgh, Pa. (B 1654)

Industrial Air Cleaning

Bulletin No. 904 discusses the use of electrostatic precipitators for air cleaning. The Pangborn Corp., Hagerstown, Md. (B 1655)

Surface Hardening by Induction

The TOCCO Process is discussed in an illustrated leaflet of The Ohio Crankshaft Co., Cleveland, O. (B 1656)

Chapmanizing

A pamphlet devoted to Chapmanizing compares it to nitriding and carburizing. The Chapman Valve Mfg. Co., Indian Orchard, Mass. (B 1657)

Electric Furnaces

Catalog No. 23 devoted to the Ajax Wyatt electric furnaces, claims highest possible thermal efficiency and automatic circulation of metal bath among their advantages. Ajax Electric Furnace Corp., Philadelphia, Pa. (B 1658)

Rapid Moore Lectromelt Furnaces

Bulletin No. TC describes patented lift and swing-aside-roof type quick top-charge electric melting and refining furnaces. Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa. (B 1659)

Molybdenum in Steel

Data on different types of molybdenum steels are given in an illustrated booklet of the Climax Molybdenum Co., New York, N. Y. (B 1660)

Ajax-Northrup Induction Furnaces

Bulletin No. 11, superseding Bulletin No. 6, is devoted to the large coreless induction furnaces of the Ajax Electrothermic Corp., Trenton, N. J. (B 1661)

Aluminum

An attractive booklet "Aluminum in Shopfitting and Display" contains a section devoted to practical points on use and fabrication. Arthur Seligman & Co., Inc., New York, N. Y. (B 1662)

Liquitol

Bulletin A1-16-A deals with the use of Liquitol for iron and steel castings and ingots. Alpha-Lux Co., Inc., New York, N. Y. (B 1663)

Stainless Steels

This company claims that its materials are manufactured by special processes providing a closer metallurgical control than has been obtainable heretofore. Rustless Iron and Steel Corp., Baltimore, Md. (B 1664)

Dipping Baskets

In addition to the 14 standard designs, this company will manufacture baskets to specifications. C. O. Jelliff Mfg. Corp., Southport, Conn. (B 1665)

Electric Air Tempering Furnace

Comparative costs in operation of the new air tempering furnace and the old salt bath show a distinct saving by the use of the new furnace, as well as improvement in quality and uniformity, according to Leaflet 36A of the American Electric Furnace Co., Boston, Mass. (B 1666)

New Equipment and Materials

Automatic Machine for Fluxing

The Automatic Gasflux Co., Cleveland, is marketing a new machine that automatically dispenses brazing flux. The gas line runs through this "Gasfluxer," and as the gas passes through, it is impregnated with a special flux. The flux then travels with the gas to the torch tip and is expelled in the flame.

The special flux used is the result of long laboratory experiment by Gasflux engineers. It has a very low melting point and as a result, coupled with the fact that it is dispensed in a minimum quantity heretofore unobtainable, the flux creeps ahead of and is always under the brazing puddle. It penetrates thoroughly and quickly, preparing the metals in such a way that an unusually tight weld is secured.

Production shops have long recognized the value of low temperature brazing compared to other methods of joining. This is particularly the case in joining dissimilar metals, or light and heavier gage metals, where the heat entering the metal becomes a troublesome factor. This process, by speeding up low temperature brazing, overcomes that heat factor. So many other difficulties were present in the brazing process, that many production shops gave up the idea. For example, when an ordinary dry flux is used, and the welding rod is dipped into the dry flux, it is impossible to regulate the amount of flux picked up by the welding rod. Consequently, too much or too little flux is used. When not enough flux is used, the joining is not tight. When too much flux is used, the weld is usually pitted by explosions that take place in the puddle. This excess fluxing also causes a deposit of very hard, enamel like substance to form on the weld as well as in the weld. This foreign matter not only weakens the weld, but it has to be removed from the surface of the weld. The only way this hard, foreign matter can be removed is by pickling and in many production shops this is either impossible or too costly to consider.

At present, this process is used for the application of brass to steel, semi-steel, malleable iron, galvanized iron, nickel, copper, monel and other alloys. The savings claimed available are: Much faster welding, fewer rewelds, certainty of the lack of porosity in the joining material, less weld metal used, less grinding and no pickling. Of great importance is the fact that the automatic regulation and dispensing of the flux, make the entire brazing operation automatic — that is, the gas is regulated, the air is regulated and now the flux may be regulated with equal precision. The resulting uniformity in the joining practically eliminates a bad weld.

The Gasfluxer and Gasflux can be used with all types of equipment as well as any standard gas. No changes are required in torches, tips or regulators. Any experienced welder can use the equipment without special instruction. One Gasfluxer assembly of the proper size will provide flux for as many torches as required on a single gas line.

Manufacturers are invited to send to the Editor items which are suitable for this department. Illustrations are acceptable, preferably in the form of cuts no more than 2 in. wide.

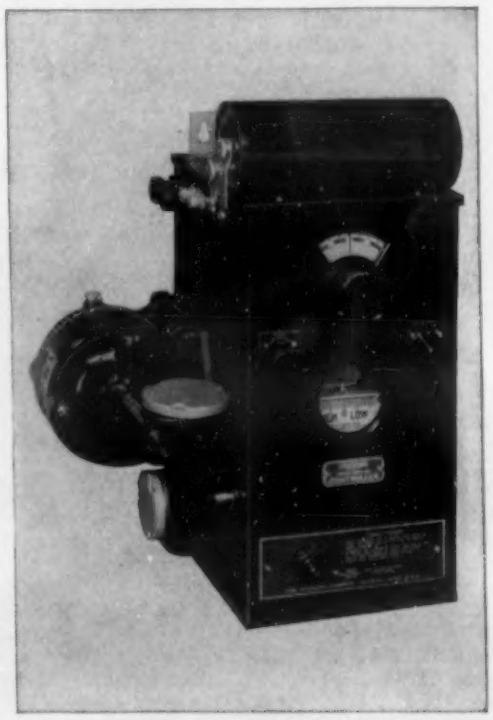
New "Speed" Primer Developed

A new synthetic primer for use on metal products that air-dries out of dust in 5 min. and, therefore, reduces the rejects due to shop dust and dirt, has been developed by Maas and Waldstein Co., makers of industrial finishes, Newark, N. J. This new "speed" primer is suitable for use under air-drying lacquer-enamels or baking synthetic enamels, or as a shop coat. It air-dries, or can be force dried or baked, giving a very flexible schedule ranging from 2 hrs. at 160 degree F. to 20 min. at 275 degrees F. It has good adhesion, excellent building and holding properties and is easily sanded. It is supplied in many colors for either dipping or spraying.

Foxboro Throttling Controller

A new "Throttling Potentiometer Controller", designed to provide close temperature regulation for heat-treating furnaces and similar applications, has been introduced by the Foxboro Co., Foxboro, Mass. The electrically-operated control system regulates the position of a throttling valve to maintain the flow of fuel required to hold the temperature constant within the throttling range. Thus, the upsetting effect of abrupt changes in fuel supply is avoided, and the temperature remains constant within a narrow control zone.

Operation of the unit is based on the familiar potentiometer pyrometer circuit, but utilizing a second slide wire in the control circuit for



smooth operation. When the galvanometer pointer contact unbalances the bridge on a change of temperature, a sensitive relay detects the current flow and causes a corresponding readjustment of the motor operated valve, at the same time adjusting the slide wire contact to rebalance the bridge circuit. The change in the valve adjustment for a given deflection of the instrument may be as great or small as desired.

This type of temperature control is said to be particularly suitable for precise regulation of furnaces operating under fairly uniform conditions of loading, fuel pressure, B.t.u. value and the like, where a definite furnace temperature may be expected for each position of valve opening. While it does not provide control as completely independent of all furnace variables as does the "Stabilog" system, the throttling control permits substantial economy for a large number of furnace applications. A simple manual reset is provided to compensate for such periodic changes in operating conditions as may occur. The new controller is known as Model 4038. In connection with other Foxboro temperature control instruments, it is said to round out the line to provide for the entire range of furnace applications, simple or complex.

Automatic Vapor-Spray-Vapor Detrex Degreaser

The complete line of standard and special degreasing machines manufactured by the Detroit Rex Products Co. of Detroit, has been augmented by a large, completely automatic degreaser. It is used for the cleaning of miscellaneous metal stampings.

This special vapor-spray-vapor machine is equipped with a two-strand, cross-rod type conveyor arranged for loading and unloading at the same end. The work is placed in perforated baskets which are hung from the cross-rods of the conveyor. In passing through the

degreaser, work is lowered into the hot solvent vapors which thoroughly wet the work and remove part of the heavy contamination. As the conveyor moves horizontally along the machine beneath the water jacket condenser, clean warm solvent is pressure-sprayed onto the work from banks of spray nozzles. This mechanical action forcibly removes and drives off the solids. A final cleaning in pure solvent vapors insures complete removal of oil and grease. Returning back overhead to the loading and unloading station, the work emerges clean, warm, and dry —ready for subsequent finishing operations.

Steam coils are placed in the boiling sump and in the clean solvent distillate collecting sump. Galvanized steam coils are welded to removable clean-out doors. A vapor-actuated, air-operated control system, consisting of thermostat temperature indicator and valve, is used to regulate the heat input, control the height of the vapor column, and insure maximum operating economy. A self-actuated valve in the steam line which heats the clean solvent distillate controls the temperature of the hot solvent used for spraying.

A water jacket condenser and a solvent collecting trough encircle the machine. The collecting trough is arranged so that the clean distillate can be made to flow into the spray sump at the right end of the degreaser or into the clean solvent storage tank at the back of the machine. The solvent that drains from the work, as well as the over-flow from the clean solvent spray sump, flows back into the boiling sump.

The clean solvent storage tank is of sufficient capacity to hold all of the solvent from the machine during the distilling operation. In this way, the contamination is removed and the solvent reclaimed for further use by distillation within the machine itself.

The rated production cleaning capacity of the degreaser shown in Fig. 1 is approximately 3000 lbs. of work per hour at a normal conveyor speed of 6 ft. per min. The conveyor speeds can be increased to 12 ft. giving 6000 lbs. produced per hr. The overall dimensions of this unit are approximately 13 ft. long, 7 ft. wide, and 11 ft. high. The solvent capacity is only 120 gallons.

Pyro "Bi-Optical" Pyrometer

The "Pyro Bi-Optical Pyrometer," manufactured by the Pyrometer Instrument Co., 103-105 Lafayette St., New York, is a patented, combined color pyrometer, whose measuring principle was evolved after years of scientific research and investigation, and developed by the company into a convenient and handy self-contained instrument for practical purposes. The present invention is based on the use of light filters and color wedges which are transparent to a number of colors simultaneously. By using filters with a number of transparencies both for separation and for mixing and toning down, any complicated optical or mechanical device for the production or combination of colors is rendered superfluous and the creation of a surprisingly simple temperature measuring device in the form of colored discs is rendered possible.

The new PYRO "Bi-Optical" pyrometer is the only instrument for technical and scientific measurements by which the temperature of the "black body" and the "actual" temperature may be ascertained simultaneously. The instrument is furnished with scale ranges from about 900 to 1900 deg. C. or 1700 to 3500 deg. F. This new instrument may be used for innumerable laboratory and research applications including incandescent iron and iron alloys in the open and flame heated furnaces, etc. It will be exhibited for the first time at the forthcoming National Metal Exhibition, Atlantic City.

High Temperature Electric Furnace Element

An electric furnace element capable of operating at 3000 deg. F. was exhibited under operating conditions in Pittsburgh beginning the first week in November. The element has been developed by Dr. Paul Schwarzkopf, a famous pioneer in powder metallurgy, in his laboratories at Reutte, Austria. The makers claim that such elements, after operating 4400 hrs. at a temperature of 3000 deg. F., have shown no evidence of deterioration. As a result of tests made in Europe, the element appears to be resistant to hydrogen, oxygen, hydrocarbon, sulphur, and its combinations. The element holds out much promise of being used in air, neutral, reducing and oxidizing atmospheres, in vacuum, or even in sulphurous atmospheres. It should, therefore, be suitable for use in glass furnaces, ceramic furnaces, as well as in the metal industry.

If the element has the characteristics claimed for it, it will open a much larger field for the use of industrial furnaces and might in time even be used in the electric kitchen stove, where it would give the electric stove the quick cooking characteristics of the gas stove. The present tests, however, will be confined entirely to the use of the new element in industrial furnaces.

Arrangements for the testing were completed in behalf of Dr. Schwarzkopf by Pierce T. Wetter, American Cutting Alloys, 500 Fifth Ave., N. Y. Mr. Wetter stated that manufacturers and users of electric furnaces would be invited to check the tests and that M. H. Mawhinney, consulting furnace engineer of Salem, Ohio, has been retained to work with furnace manufacturers in studying the new element to see its application in industrial furnaces. If the element fulfills the claims made for it, the manufacture in this country will be started.

Inspection Without Damage

A method of inspecting machine parts for hidden flaws without injuring or changing them has been developed by the General Electric Co., Schenectady, N. Y. According to J. A. Sams of the company's Schnectady works laboratory staff, the method depends on the principle that any substantial change in the constitution or state of magnetizable material will be reflected in its magnetic characteristics.

"A constant magnetic field is produced so that it penetrates through the entire thickness of a small area of the part to be inspected," says Mr. Sams. "The part is slowly revolved so as to change continuously the section within the field, until the whole part is magnetically explored. Imperfections such as voids or nonhomogeneous areas in the interior betray themselves by producing disturbances in the magnetic field at the surface of the part.

"Magnetic seach coils are mounted close to this external surface. Any sudden change in the magnetic linkage, created by a discontinuity in the metal of the part, produces a corresponding sudden electric voltage in the external measuring circuit. The imperfection is detected and the defective part is discarded."

Portable Electric Polishing

The Finishing Equipment Co., 222 E. Ohio St., Indianapolis, Ind., is placing on the market a portable electric unit for sanding, rubbing and polishing, which is adaptable to a wide range of work in several different industries. The "Dual-Blok" Portable Electric Sander-Rubber-Polisher is streamlined in design and has a rhythmic balanced mechanism that produces a smooth, quiet, reciprocating motion to two rapidly moving blocks which stimulate a tremendously speeded up hand motion.

Fitted with abrasive paper drawn tightly over the reciprocating blocks, the machine

can be used for smoothing the surfaces of bare wood or metal, spot sanding and feather edging; for removing old coats of paint or varnish and for sanding lightly between coats in the course of the finishing process. It can be used on flat or curved surfaces and against the shoulders of inside corners, and is also adaptable to either dry or wet sanding. With only the felt pads exposed, the machine serves as an excellent portable rubbing machine, working with pumice and oil, pumice and water, or with any other rubbing or polishing compound.

With polishing cloths or sheep's wool drawn over the pads, the machine becomes an ideal rapid polisher for furniture, caskets, woodwork, automobiles or any finished, plated or waxed surface capable of being polished.

A handy extension cord plugs into any electric light socket; for A. C. or D. C. electric service, 110 to 115 volts; weight is approximately ten pounds; size 11" long, 8" high and 3½" wide. Ball bearing equipped. Patent has been allowed.

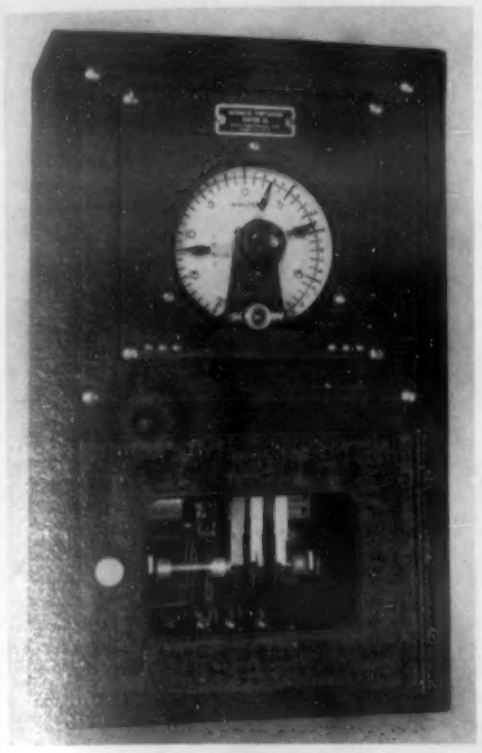
A Photoelectric Potentiometer

Operating characteristics and fields of application for the Weston Model 721 photoelectric potentiometer and its related equipment are described in a bulletin issued by the Weston Electrical Instrument Corp., Newark, N. J. The bulletin outlines the unique electronic balancing method of the new instrument, which permits widened application of potentiometric sensitivity to continuous measurement and control of rapidly varying electrical quantities, or other quantities (temperature, light, etc.) which may be translated into electrical units. Because the potentiometric balance is continuously maintained by electronic, rather than mechanical, self-adjustment, the unit acts as a continuous amplifier of electrical input variations too minute for utilization by other means, producing a proportionate output of direct current of an order sufficient to operate standard indicating, recording or control instruments. Instruments operating on this amplified output can be calibrated in terms of the primary variable — current, temperature, conductivity, and the like.

Among the fields of application for the unit suggested in the bulletin are pyrometry, electrochemical measurement and control, standardization and regulation of currents, voltages, light values, etc., magnetic testing, seismograph recording and biological and physiological measurements. Copies are available on request.

Timer for Automatic Reversal of Furnace Firing

The new timer, developed by the Automatic Temperature Control Co., Inc., Philadelphia, is designed to control, on a time basis, the firing of furnaces which are fired at each end, such as soaking pits and open hearts. On the upper half of the instrument is a dial having two preset pointers and one pointer which



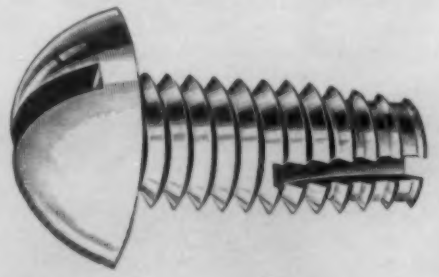
moves during timing operations. Each fixed pointer is controlled by a separate knob and is set for the desired firing time on the right and left ends of the furnace respectively. The total firing cycle of the furnace, as set up in the illustration, is the sum of the two pointer readings—21 minutes.

The traveling pointer is shown as it has passed the center position and is moving to the right. On reaching the right fixed hand, it reverses and comes back to 0 in 9 min., at which time a contact is made which starts the cam timer shown through the window in the lower half of the case. The moving pointer continues to the left, makes contact with the left fixed hand and comes back to the 0 point in 12 min., at which time the contact is again made to start the cam timer and the cycle is continued.

The cam timer shown controls two separate load circuits. Each time contact is made by the moving hand above, the cam timer makes ½ revolution, energizing one or the other load circuit depending upon the direction of motion of the dial hand. Energizing these cam load circuits starts the train of operations necessary to reverse the firing, shutting down the burners on one end, reversing dampers and starting the burners on the opposite end, together with any other operations which may be necessary for the reversal. This cam unit can be arranged to operate each valve or damper directly if desired, and, for this purpose, can be equipped with any required number of load circuits.

Thread-Cutting Screws

The Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, has recently announced the development of a screw that actually cuts its own thread in metals and plastics of practically any thickness. Its patented, thread-cutting slot, plus a special hardening process, eliminates the separate tapping operation normally required in the use of standard machine screws. Important production savings in both labor costs and time are assured by the use of this new fastening method and, because the screw remains in the threads it has cut, a better fastening is certain. Another advantage is the fact that, should it ever be necessary to replace the screw, an ordinary machine screw of the same size will fit its threads.



A New Haynes Stellite Cutting Tool

Haynes Stellite Co., Kokomo, Ind., is now offering a new, patented cobalt-chromium-tungsten alloy for metal cutting tools. The new alloy, which is known as "Haynes Stellite-2400", has been developed by Union Carbide and Carbon Research Laboratories, Inc., and Haynes Stellite Co., two units of Union Carbide and Carbon Corp.

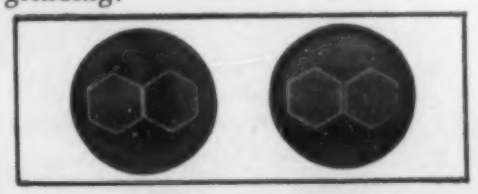
The introduction of the new alloy represents another step forward in cutting tools. Each major improvement since the early days of metal machining has been the development of a tool capable of cutting at increased speed without any sacrifice of feed or depth of cut. Haynes Stellite-2400 tools, having greater edge strength, operate with economical tool life at even higher speeds than Haynes Stellite J-Metal, with no reduction of feeds and depths of cut. Haynes Stellite-2400 cutting tools are marketed in a variety of sizes of solid square and rectangular tool bits, welded tip tools, milling cutter blades, and special small tools to suit requirements. On production operations, this new Haynes Stellite alloy has shown marked superiority over tools previously used, including J-Metal. Already the excellent performance of this material has proved it suitable and economical for roughing and finishing cast and forged steels; nitrided, stainless, and other alloy steels; cast iron and other malleable iron.

9 Lives for Chapmanizing to 1 *for* Carburizing

In only 1 to 4 hours, Chapmanizing imparts a ductile-tough case to free-machining steel that outwears a carburized case 9 to 1. . .and holds its own with costly nitrided alloys.

The process is simple. . .nitrogen is added to iron-base alloys by heating the metals in the presence of nitrogenous material. Bath retains long-term stability. Parts come out silver-clean, free from soft spots. They can be bent, straightened or abraded without cracking or warping. And they require less time for machining and finish-grinding.

Chapmanizing involves no special furnace. . .no investment. Simply install the Chapmanizer Unit on a contract basis, hook it up to your present furnaces. Find out whether this patented process can cut your costs and improve your product as it is doing for others. Write for new book.



Case Depth, 1 hour of Chapmanizing on SAE 1315 steel.

Case Depth, 4 hours of Chapmanizing on SAE 1315 steel.

The **CHAPMAN VALVE**
MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS U. S. A.

"Zincgrip"—New Galvanized Sheet

Armco research has perfected a revolutionary type of galvanized sheet with a heavy coating of commercially-pure zinc that will not crack or peel when it is subjected to relatively severe drawing or forming operations, according to an announcement by W. W. Sebald, vice-president of The American Rolling Mill Co., Middletown, Ohio. The new material, produced in both sheets and coils, is appropriately known as "Zincgrip." It carries from 50 to 75 per cent more protective zinc than tight coat sheets generally used for fabricated products. Up to now, hot dipped zinc-coated coils in sheet widths have not been produced. Armco Zincgrip, from 16 to 28 gage, is made available in any of the basic grades of galvanized iron or steel sheets and strip manufactured by the company.

It is an accepted fact that zinc provides an excellent protective coating for iron and steel sheets. Broader use of heavily coated galvanized sheets has been restricted only because relatively severe fabricating operations fractured the zinc coating. With the new Armco Zincgrip sheets, exceptionally good adherence is obtained irrespective of the weight of the coating, the company's metallurgists say.

Potential applications are said to open new fields for the use of zinc-coated Armco Ingot

Iron and steel. For more than a year, Zincgrip has been used in the production of spiral corrugated lockseam drainage pipe and has proved entirely satisfactory, the company's announcement says. According to extensive experiments made by the company and by fabricators, it is well suited for other products such as roof drainage parts, shapes and stampings made by cold drawing and rolling processes, and many other applications.

Zincgrip's highly protective coating and its ability to withstand a heavier draw than has ever before been accomplished with full-weight galvanized sheets make it attractive for many kinds of fabricated products where resistance to corrosion is desirable.

Application of Submerged Gas Combustion

An improved method of heating liquids in open tanks, new to the public and which is known as Submerged Gas Combustion, was announced at the 19th Annual Convention of the American Gas Association in Cleveland. A description of the operating advantages and economies of this new development was given in an important paper before the Industrial Gas Section by C. H. Lekberg, Northern Indiana Public Service Co., Hammond, Ind.

In this new method the flame is directed through a tubular combustion chamber which conducts the hot products of combustion down to and across the tank bottom where they may be vented and distributed to give the rate and control of agitation desired. This produces a violent agitation which is of particular value in such operations as pickling in steel mills. This method also opens up possibilities for the extension of gas service in other fields such as, for instance, the heating and agitation of cleaning solutions.

The production rate of a pickle tank in a steel mill can generally be increased 100 per cent by the use of submerged gas combustion, but experiments in one mill indicate that 3½ times the old rate could be accomplished if the material handling equipment were adequate. Acid dilution is a considerable factor where live steam is employed but with submerged gas combustion this element is entirely eliminated and acid savings of 25 to 50 per cent are thereby effected.

As the rate of scale removal is in almost exact proportion to the rate of agitation one feature of this unit is that an exceptionally high rate of agitation can be maintained regardless of the solution temperature or rate of heat input. The new gas burner system is entirely automatic in its operation and controls pickle temperatures to meet the most exacting conditions. Individual submerged gas combustion units make of each pickle tank an independently operated unit free from a central boiler installation. This provides the much-to-be-desired flexibility of operation.

In the past year one steel plant in the Hammond, Ind. territory, saved 72c per ton on all steel pickled by submerged gas combustion. This saving was sufficient to write off the cost of the gas burner equipment in a few months. This mill now has four submerged gas combustion burners replacing 70 boiler h. p. of steam. Equipment has been ordered to replace an additional 150 boiler h. p. and this will place all pickling and solution heating, in this plant, on the new gas method.

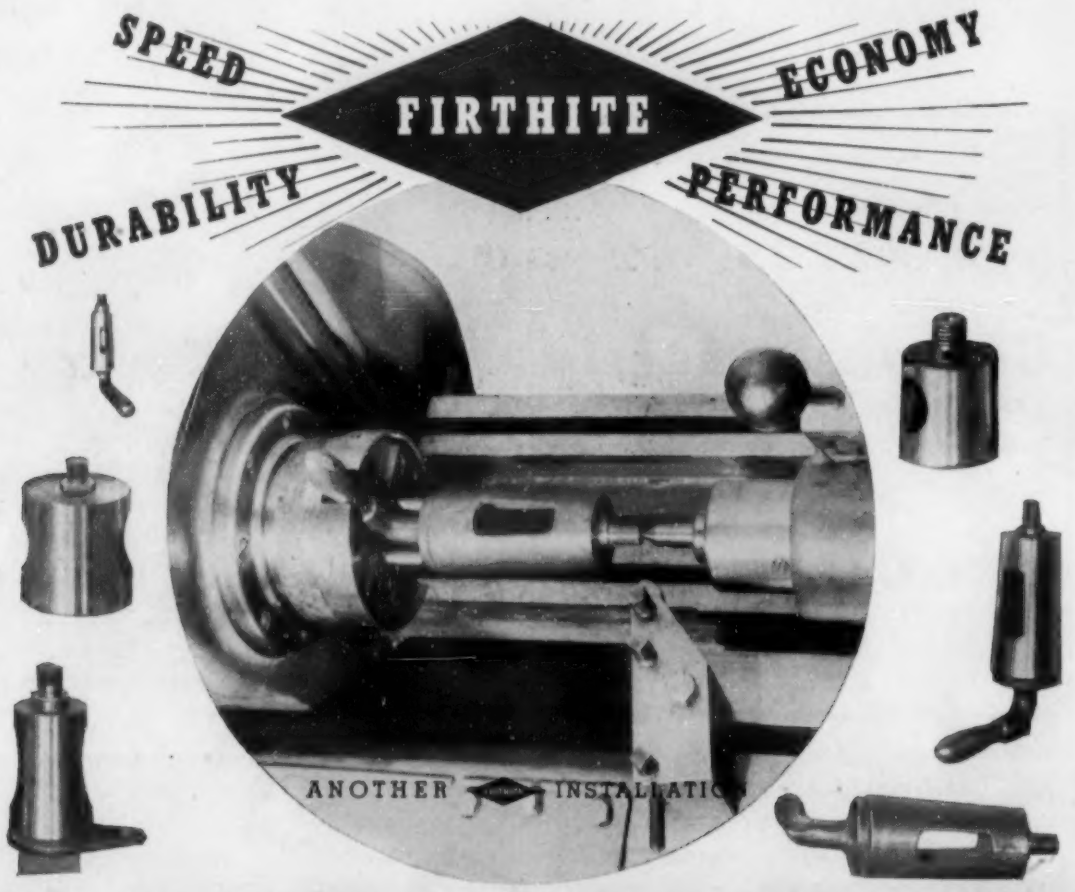
New Drinking Fountains

Factory and office building managers, perpetually faced with the problem of drinking fountain installations as contributions to the health, comfort and efficiency of employes, will be interested particularly in six new drinking fountains just brought out by Crane Co., Chicago. They are made of vitreous china and sculptured in a modernistic, easy-to-keep-clean design that is both rugged and attractive.

The Erie line is offered in three new models. One of these with integral strainer is equipped with two bubblers, automatic stream regulators and improved self-closing valves and loose key stops. Other new Erie fountains include a single bubbler with a push-button, self-closing ice water faucet and also a combination bubbler and ice water faucet with glass receptor. The new Ontario fountain with two bubblers is similar to the Erie except that it is of the roll rim type supported on brackets.

There are two fountains in the Oasis model. They are of unusually distinctive design. The supply and waste fittings are concealed in a housing to improve the appearance and eliminate condensation. Both of the fountains have vitreous china backs, one eight inches high, the other fifteen inches. Either of these fountains can be had with ice water faucets if desired.

In all instances the bubblers are located above the rim to avoid back-siphonage.



FOR SUSTAINED ACCURACY USE FIRTHITE

Despite the intermittent character of the cut due to the transverse slot through the valve inserts, FIRTHITE Tools produce hundreds of large cast brass valve plugs from 4" to 11½" dia., all of which easily pass the exacting "prussian blue" test for percent of bearing.

FIRTHITE Sintered Carbide Tools faithfully reproduce on all sizes of valve plugs, the fine accuracy built into this Sundstrand Lathe.

TYPICAL CYCLES ARE: (On a 4.9" length cut)

For Roughing—35 seconds floor to floor time. 585 feet per minute, 0.015" feed, 3/32" cut. (at the rate of 87 pieces per hour assuming 81% efficiency)

For Finishing—50 seconds floor to floor time. 980 feet per minute. 0.005" feed, 1/64" cut. (at the rate of 61 pieces per hour at 85% efficiency)

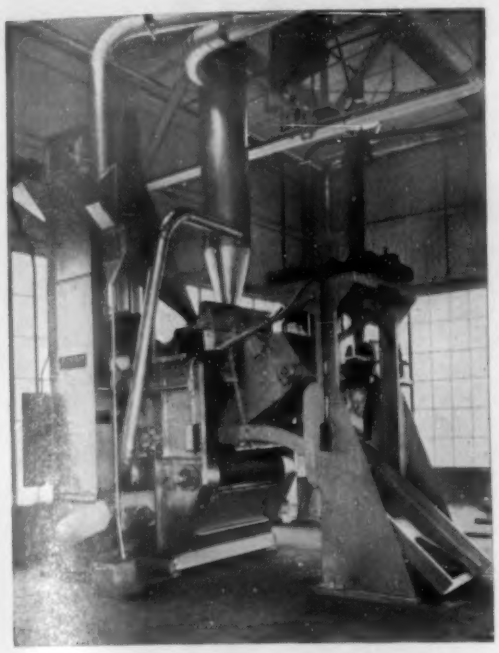
FOR SUSTAINED ACCURACY AND HIGH PRODUCTION USE FIRTHITE

FIRTH-STERLING STEEL COMPANY

Works: McKeesport, Pa.
New York · Chicago
Hartford · Philadelphia
Los Angeles · Detroit
Cleveland · Dayton
Globe Wire Division
McKeesport, Pa.

A 36 in. x 42 in. Wheelabrator Tum-Blast

A new model 36 in. x 42 in. Wheelabrator Tum-Blast has been announced by The American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind. Many new features have been incorporated in the design of this centrifugal abrasive blast cleaning equipment. Fabricated steel side frames replace cast iron frames formerly used, making the unit much stronger. Welded corner and joint construction assure extra ruggedness and dust-free



operation. Centrifugal force is utilized in whipping steel abrasive onto metal pieces being cleaned in the 36 in. x 42 in. Wheelabrator Tum-Blast; a gentle tumbling and complete exposure of all parts in the blasting zone being attained through the use of an endless conveyor apron.

An improved suction type abrasive separator is included at the elevator head as standard equipment on the new model. This separator effectively keeps the abrasive clean by removing dust and broken down abrasive after burned molding sand, forging scale and other foreign material is extracted by the rotary screen. The new 36 in. x 42 in. Wheelabrator Tum-Blast with the standard conveyor will clean metal parts weighing up to 30 lbs. Pieces weighing as much as 75 lbs. can also be cleaned, when the machine is equipped with a heavy-duty conveyor.

Complete information on this new model and other types of Wheelabrator equipment is contained in catalogue No. 211, which can be obtained from the manufacturer.

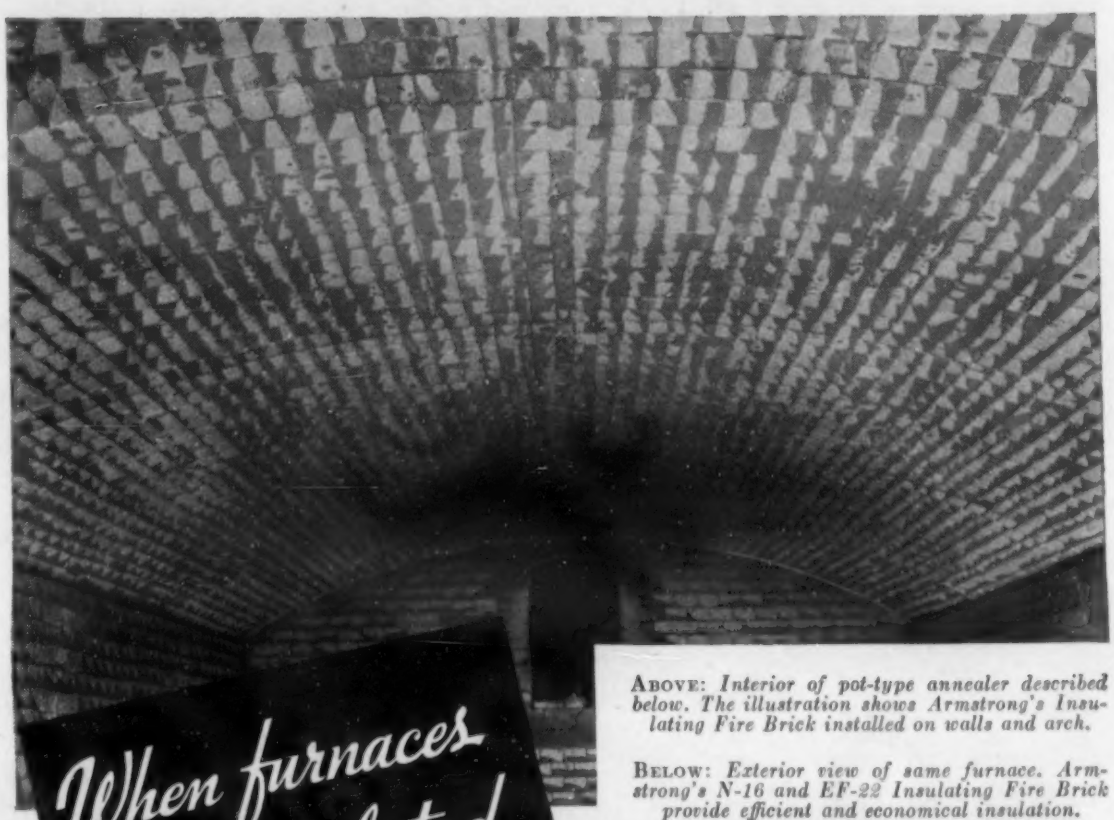
New Hard Cutting Alloy

"Tantaloy" is the trade mark of a new hard cutting tool and wear resisting alloy developed by Fansteel Metallurgical Corp., North Chicago, Ill. It is a general purpose hard metal ordinarily used as a tip which is brazed to a steel shank to form a cutting tool.

Containing tantalum carbide, Tantaloy is claimed to possess the characteristics of a high degree of chip slippage which resists the development of crater by the chip action. When regrinding, Tantaloy tools require very little metal removal, thus decreasing the grinding time and increasing the useful life of the tool. An outstanding characteristic is toughness, making Tantaloy tipped tools highly efficient for service ordinarily regarded as severe, such as interrupted cuts, heavy feeds, varying hardness of metal, or tool mounting essentially deficient in rigidity.

Tantaloy tipped tools are available in all standard lathe, boring mill and turret tool sizes; also the metal is available in tips which may be brazed to boring bars, counter bores, or special tools. Tantaloy is recommended for gages, lathe centers, centerless grinder rests, wearing surfaces, and the general field of application of abrasion and corrosion resisting metal.

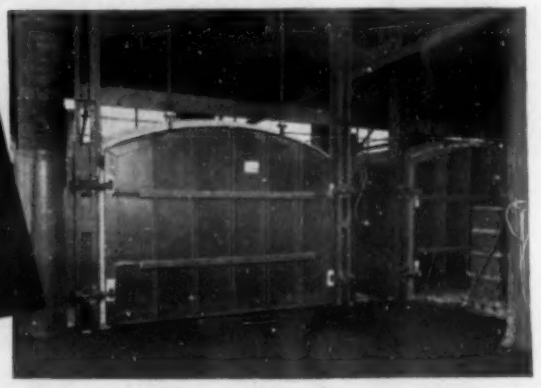
THINNER WALLS
QUICKER HEATING
LOWER FUEL COSTS



ABOVE: *Interior of pot-type annealer described below. The illustration shows Armstrong's Insulating Fire Brick installed on walls and arch.*

BELOW: *Exterior view of same furnace. Armstrong's N-16 and EF-22 Insulating Fire Brick provide efficient and economical insulation.*

When furnaces are insulated with Armstrong's **BRICK**



EFFICIENT insulation is provided in the furnace shown above by the use of Armstrong's Insulating Fire Brick on the interior walls and arch. The furnace is a pot-type annealer constructed by the Whiting Company for the James Manufacturing Company, Fort Atkinson, Wisconsin.

Armstrong's Insulating Fire Brick offer many important advantages to furnace builders and plant supervisors because they combine the service secured from fire brick with the fuel savings of insulating brick. They permit thinner walls and consequent larger hearth area. Their light weight makes them ideal for arch work. And because of their low heat capacity, these brick permit the furnace to come to temperature more quickly.

Use of Armstrong's Brick in furnaces of all types, assures a more rapid turnover with less investment in furnace capacity, as well as definite fuel savings. Armstrong's Line of Insulating Fire Brick includes five types covering a complete range of temperatures and uses, behind the refractory and for direct exposure. For full information, and for your copy of the new, illustrated booklet, write Armstrong Cork Products Co., Building Materials Div., 982 Concord Street, Lancaster, Pa.

Armstrong's

HIGH TEMPERATURE INSULATION

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